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TRANSACTIONS.

ART. I. *Prussia and the German System of Education: prepared and read by* ARTHUR BOTT, Esq.

The power which now speaks to Europe in the name of Germany, and which certainly bids fair to unite all German states under her sceptre, was unknown at the period of the Reformation.

The counts of Hohenzollern descend from tributaries of Charlemagne. Their house long maintained a precarious existence as a fief of Poland. From the beginning, it clutched at every territory within its reach, swallowed up the smaller ones wherever found, near or far, and left to time the consolidation of the fragments into one organic body. If proprietors of intervening territory could not be subdued, they were cheated in barter or caught in the meshes of Venus. From the swamps of Brandenburg, hardly larger than an English county, the counts of Hohenzollern dotted western and northern Germany with these demesnes. The Jülich and Cleve duchies lay leagues away from Brandenburg, as Brandenburg was far away from Stettin; and none of them had any topographical connection with eastern Prussia. All these acquisitions were rather the outposts of a projected kingdom than vital members of one political body. In every European treaty Prussia secured some new dominion. Early in the eighteenth century Austria permitted her to

assume a royal dignity. This was the crisis of her history. The sword of Frederic, by incorporating Silesia and Posen, raised her from a feudatory of Austria, to a powerful rival; and while the latter still hugged the rude old feudal system, Prussia, by employing every new, wise principle of national progress, obtained the commercial, and through this, the political control of all Germany. In her enlightened system of public education, her commercial codes based on strict reciprocity; by political representation and the widest religious freedom; she presents, beside the neighboring despotism, all the contrast of science with ignorance, of integrity with corruption, of light with darkness.

In her political alliances, Prussia has one principle — that of a selfish expediency. She accepts the hand of either belligerent, like a partner in a dance. She has kidnapped the states which she could not honorably annex, as Frederic kidnapped recruits for his giant regiment. She has trampled on every principle of international law and perpetrated every crime necessary to her ends. She instigated and mainly procured the dismemberment of Poland. Her own original fief was torn from the knights whose interests she had sworn, as chief and guardian, to defend. Two of the most important members of the empire were seized by acts of buccaneering unsurpassed in the history of nations. While accepting British money to despatch troops to Austerlitz, she was negotiating with Napoleon for British Hanover as the price of neutrality. She pledged herself to Napoleon to guard the rear of his Russian army and then fulfilled the pledge by turning thirty thousand bayonets against his frozen, perishing fugitives. Treacherous to the last, she made a tool of Austria to subdue Schleswig-Holstein and then seized the whole prize, kicked Austria out of doors, and ground the whole confederation to dust.

But she has characteristics which might redeem her rapacity. Her kings and electors have been frugal, even to parsimony, in their households — not for family aggrandizement but to lighten the public burdens and to create an efficient civil and military department. They have melted their plate, slept on hard beds, dressed in frieze, eaten peasant's food, to keep the national expenses within the receipts. William I. sold his jewels, sent his spoons to the mint, abolished the costly court ceremonies, even dismissed the wig-maker and barber, in order to establish a school for the army. As a consequence, Prussia shows, up to this day, the cleanest yearly balance sheet of Europe. While other nations become insolvent in peace, Prussia clears off her debts even in time of war. New states are made to pay the expenses of their own annexation. The sinking fund will remove the present indebtedness within twelve years. This personal interest thus extended to the people by their rulers gives a peculiar freedom to the life of the latter; absolute in its social and religious elements and yet modified by the sovereign's paternal care. A Jew may guide the Prussian parliament, a Roman Catholic may mount the throne. To every child in the land, of either sex, however remote or however poor, the government furnishes freely seven years of sound, generous education. The Prussian people thus enjoy all the splendid advantages of a great empire with the financial ease and social and religious liberty of a petty state. Although the countries which she has violently seized, struggled at first like the Sabine women, they now seem only to desire the closest intimacy with their captors. Certainly they have gained much and lost little by their change of masters.

Administration of Public Instruction.

The administration of Schools was centralized only in the present century, by transferring it to the Ministry of the Interior. Here it was placed under the immediate direction of William Humboldt, as State Councillor. Since 1817, Educational and Ecclesiastical matters have formed a special Ministerial department.

Under this Central Department, stand eight Provincial Administrations, which recognize local and sectarian peculiarities. In each province, a Deputation regulates all the internal affairs of church and school; determining the general object of the educational institutions; examining their statutes and discipline; proposing plans of improvement and designating text-books; supervising the higher schools and appointing or removing teachers. The provincial boards manage the property of church and school and regulate the elementary and primary departments of the latter, and report to the minister six commissions, distinct from these boards, examine teachers for the higher schools, and revise the examinations for graduation. Each commission has seven members; one for each of the following branches—Philology, History, Mathematics and Physics, Science of Teaching, Theology, and Hebrew, Natural Sciences, Modern Languages.

By the Prussian constitution, all schools and universities are declared Institutions of the State; they cannot be established without the consent of the state and are subject to its supervision; they are open to all sects but persons dissenting from their religious system are not required to attend the religious instruction; schools and Gymnasia for the higher sciences and the arts and trades, enjoy the same powers as corporations and are controlled immediately by the state authorities; teachers not appointed by persons or corporations, through legacy or special

privilege, are appointed by the state; schools conducted by private persons or corporations are subject to supervision of the Provincial Boards, as to their teachers and discipline and instruction. Also, the supervisors must dissuade persons evidently incompetent, from entering the learned professions; they must encourage and aid youth of superior talent; no dismissal can take place, without a testimonial of mental and moral character. The mode of education of the child is left to the father's choice, but the necessary instruction in religion and useful knowledge according to his position must be imparted. Any person may instruct, after authorization by the state. Teachers of the Gymnasia and other higher schools are declared officers of the state.

In Germany, education is compulsory on both sexes, for seven years from the child's sixth or seventh year. This education is merely elementary. The state, however, is obliged to prepare the indvidual for his future vocation.

In the large cities, free schools especially for the poorer classes are maintained by the municipality aided by the state; all teachers are appointed by the government and the municipality jointly, and the schools are supported by the latter.

In 1857, Prussia contained 27,963 elementary schools with over 30,000 teachers and 2,859,694 scholars; and 1,171 private schools, with 3,635 teachers and 83,021 scholars; leaving about 11,000 non-attendants. In France, at the same time, nearly one-third of the children of proper age were non-attendants and another third attended school during a few months of the year only.

Prussia has long paid special attention to its Normal system. It honors teaching as a regular profession. The teacher consequently loves his calling with enthusiasm. In the higher schools of the cities, he associates with the *elite*. In the elementary and the village schools, he and the pastor are the gentlemen of the place. He considers

himself not as laboring for a livelihood but as shaping the destinies of his nation. He retains his position, generally during life, growing old among his own pupils, whose reverent affection breathes over his declining years an idyllic charm.

The Normal Seminaries contain 39 protestant and 16 catholic instructors with 2,600 students. Before entering, the student must pass examination in the three lower branches of the Gymnasium, at least. The course lasts three years and embraces all the branches of the common school course, but especially the science of education and catechetics. The instruction is practical; the pupils applying daily their principles, under the supervision of the professors, in instructing the pupils of the schools connected with the seminary. At graduation, they pass a rigid examination *pro facultate docendi*, and enter the service of the state according to their several qualifications.

The examination *pro facultate docendi* comprises German Latin, Greek, French and Hebrew; mathematics, physics, natural history; history and geography, antiquities, mythology, history of Greek and Roman literature; philosophy and theology. It is conducted before the royal commission, is both oral and written, and includes a trial-lesson in one of the higher classes of the Gymnasium. Lately, a trial year has been introduced, to secure fuller proficiency.

There are a few seminaries for the preparation of teachers for the higher schools. Their course follows that of the University and presumes a previous complete scientific education, and a degree *pro facultate docendi*. They are connected more or less closely with the University and seek less to teach the art of teaching than to produce independent application and development of science. A Philological seminary is connected with every university. Philosophical, historical or mathematical seminaries are

rare. Students stay two years, rarely four. They compose educational and scientific treatises, and criticise them in special conferences. They take classes in the Gymnasia or study the methods of certain teachers and practice under them.

The Grammar schools are exclusively designed to prepare the sons of citizens for the pursuits of common life. Admission takes place at the ninth year, and presumes facility in reading German and Roman print, knowledge of the parts of speech, a readable and clear hand-writing, fair spelling, knowledge of the four fundamental rules of Arithmetic and acquaintance with the narratives of the old and the new Testament. After six years, the pupil is expected to write good German, to translate correctly from other tongues, to understand thoroughly the Latin grammar, and read well Cesar and Ovid; to pronounce correctly English and French and write them freely from dictation; to know the outlines of general history, the most important events of Greek and Roman history, and especially that of Germany and Prussia since the Thirty years war. He must be acquainted with the most important conditions of the earth's surface, with the topical and political geography of Europe and especially with that of Germany and Prussia; with the elements of Mathematical Geography, the chief botanical, zoölogical and mineralogical systems, the physiology and anatomy of the plants and animals especially valuable in commerce and the arts, the general properties of bodies, the laws of heat, the elements of Chemistry, Geometry, Stereometry, Plane Trigonometry, Equations, Logarithms, and Progressions.

There are countries in Germany in which the school system is even more rigidly enforced than in Prussia. Wurtemberg, for instance, with its University, its primary schools established in every hamlet, its compulsory education of children from the 6th to 14th year, has given

birth to a greater number of scholars and literary men than any other land; among them. Schiller Wieland, Uhland, Schubart, Kerner, Knapp, Schelling and Hegel.

The Schools of Industry and Arts (Real Schulen), are public institutions in which especial attention is paid to instruction in natural sciences and mathematics, and which prepare their pupils for practical life. They treat ancient languages as secondary and give to the natural sciences, geography, chemistry, history, technology, mathematics and modern languages the first rank. They dismiss their pupils to the military, postal, forest and architectural schools and services, and to all professions for which a University education is not required. There are 83 real schools with 1,037 teachers.

The following is the plan of study and number of hours per day allotted to each branch.

	CLASSES.					
	VI.	V.	IV.	III.	II.	I.
Religion,.....Hours per Week,	3	3	2	2	2	2
German,..... "	4	4	3	3	3	3
Latin,..... "	8	6	6	5	4	3
French,..... "		5	5	4	4	4
English,..... "				4	3	3
Geography and history,... "	3	3	4	4	3	3
Natural sciences,..... "	2	2	2	2	6	6
Geometry and arithmetic, "	5	4	6	6	5	5
Penmanship,... ..... "	3	2	2			
Drawing,..... "	2	2	2	2	2	3
	30	31	32	32	32	32

Before leaving the school, the pupil must pass a thorough examination, both oral and written; the latter consisting of a German, French and English composition, a translation into the Latin, the solving of two arithmetical and two geometrical problems and a treatise on some theme in Natural Philosophy and on another in Chemistry; the

oral examination testing his acquirements in religion, history, geography, mathematics and the natural sciences. In the German language, the student must be able to work out a theme in logical order and in correct, good language. He must also speak the language correctly and fluently, and must be acquainted with the principal periods of German literature. In Latin, he must be able to translate into good German, portions of Cæsar, Sallust, Livy, Ovid and Virgil, read before. In French and English he must possess a thorough knowledge of grammar and be able to write an exercise and a dictation from the German without strong Germanism or grammatical mistakes. He must also converse with some facility in these languages and have some acquaintance with their literature. He must have a systematic knowledge of universal history and general chronology. In natural philosophy he must know its laws and fundamental ideas, as well as the methods of experiment; the laws of gravitation and motion; the principles of heat, electricity, magnetism, sound and light. In chemistry and orycto-gnosy is required a knowledge, based upon experiments, of the affinities of the more common inorganic and organic substances. The student must be able to describe and to employ the best processes for the more common chemical products and also to state the nature and uses of the latter. He must exercise a scientific knowledge of the whole field of mathematics, as algebra, proportions, equations, progression, binomial theorems, logarithms, plane trigonometry, stereometry, descriptive and analytic geometry, conic sections, statics, and mechanics.

The Polytechnic Schools prepare their pupils by scientific instruction for the arts and technical professions. They differ from the common schools of art or industry in that they enter more systematically into the technical sciences, and presuppose a complete course of

the mathematical and natural sciences. They differ from other schools of learning in their manifold relations to industrial life; they treat their subjects no less scientifically but at the same time furnish opportunities for practical applications. The instruction comprises a three-years course after the manner of academies or universities; the pupil selecting his own branches. This course is divided into two parts; the first being the technical, teaching the lower and higher branches of mathematics, physics and mechanism, general chemistry, machinery and drawing. This section is subdivided into three faculties for engineering, machine-building and technical chemistry. The students in the first, study also, the higher sciences of surveying, hydraulics, road and rail-road architecture, and construct plans; those of the second are instructed in mechanism, machine-building and mechanical technology, and the planning of single machines and whole factories; and those of the third, study physics, theoretical and analytical chemistry and chemical technology and practice chemical analyses and preparations. Some branches of jurisprudence and political economy, as well as modern languages, being of equal importance to all the faculties, are taught in them all. The second section is the commercial and comprise the instruction in mercantile correspondence, in commercial sciences, commercial laws and laws of exchange, in mercantile calculations and book-keeping, in commercial geography and history and modern languages. At the end of each term, an examination is held and testimonials are given according to its result.

Germany possesses 24 schools for architecture, 12 for mining, 17 for forestry (arboriculture etc.), 31 for commerce, 46 military schools, 70 for agriculture, 10 for music, 81 naval schools, 12 veterinary schools, 12 surgical, 64 for various other sciences.

The Universities of Germany.

Universities were first founded in Germany in the 13th century. They were modeled after the high schools of the Arabs in Bagdad, Cordova, Salamanca, Seville, Toledo, and Alexandria. The studies were grammar, poetry, philosophy, law, medicine, astronomy, mathematics and practical sciences.

The Universities are the pride and glory of Germany. They exert more influence there than similar institutions in any other country. They are the centres of the higher intellectual and literary life of the nation and the laboratories of new theories of action. They reflect a picture; the whole world of nature and of mind under its ideal form. They develop the talents and form the principles of nearly all who fill the places of power in church and state, from the village pastor to the oberconsistorialrath, from the advocate at the bar to the head of the cabinet.

They receive the best minds from the lowest as well as the highest ranks and fit them for public usefulness.

From them, emanate principally the ideas and maxims whether conservative or progressive which rule the land.

It is characteristic that the Reformation in Germany, proceeded, not from princes and bishops as in England, but from theological professors.

The great philosophical and theological revolution of the last century and the counter revolution of the present century, have likewise proceeded mainly from the studies and lecture rooms of the academic teachers.

Such supremacy of literary institutions and literary men has, however, its disadvantages. It could not exist in a country like ours or England, where politics and commerce engage so large a proportion of the best talent and energy of the nation. But in Germany, it is closely connected with the genius, history and condition of the people, and

no one can form a correct idea of the nation's higher and deeper life without a knowledge of its universities.

Each nation has its peculiar mission and excellency. Ancient Israel was elected to prepare the true religion for the world; Greece to develop the principles of science and art; Rome to actualize the idea of law and civil government. So in our times, the chief significance of Germany lies neither in politics nor in war nor in commerce, but in science and literature. The German universities exert also a powerful influence upon other countries.

Situated in the heart of Europe and visited by strangers from all quarters of the globe, they are the strongholds of general learning and literature and of the highest culture of Europe and America.

Twenty six Universities exist in the entire German confederation. Of these, six belong to the kingdom of Prussia (at Berlin, Halle, Bonn, Breslaw, Königsberg, Greisswalde, to which may be added the Roman Catholic High School of Munster); six to the Empire of Austria (Vienna, Prague, Olmutz, Gratz, Salzburg, Innsbruck); three to the kingdom of Bavaria (Munich, Erlangen, Wurzburg); two to the grand Duchy of Baden (Heidelberg and Freiburg); one to the kingdom of Wurtemberg (Tübingen); one to the kingdom of Saxony (Leipsic).

Eight are Roman Catholic, thirteen Protestant, five of both creeds.

These institutions are maintained by princely or by private donations, by tithes and by annual appropriations of the government. The popes frequently transferred to them the proceeds of a part of the church property. At the Reformation, the wealth of the secularized abbeys and since 1773, that of the order of Jesuits have been largely devoted to them. They are also generally exempt from taxation and enjoy certain temporal privileges. Tuition forms the least source of income. The students pay besides

the matriculation fee, a certain sum ($2 to $10) for each course of lectures; but the chief resource of the professors is a fixed salary paid by the state, ranging from a few hundred to several thousand dollars, according to age, merit and reputation.

The university is divided into four faculties. Each faculty elects annually from itself, its own dean. At the head of the whole academic body, stands the rector or chancellor, likewise chosen annually from the regular professors of each faculty in its turn. The legislative power resides in the academic senate, composed of all the ordinary professors or a delegated number. A university is thus a complete republic of letters, highly independent of church and state, although furnishing to both, all their higher officers. This academic liberty, both intellectual and moral, the utmost liberty to teach and to learn, is cherished as one of the most precious privileges.

The four faculties embrace all the sacred and the secular sciences and make up the idea of a university; a term which was first applied to the body of teachers and pupils (universitas scholarium), but is now understood mainly of the totality of letters (universitas literarum), and the completeness of the system of instruction.

We now proceed to a separate notice of the four professional schools which form a German University:

1st. The theological faculty still has the supremacy, since, when most of the universities were founded theology was emphatically the queen of sciences. The great institution at Paris was at first simply a theological and philosophical school; the philosophical studies served as a preparation to scholastic divinity, and the philosophical professors were all ecclesiatics.

In the middle ages, theology was confined to the interpretation of the Latin Bible on the basis of the Catenæ-Patrum and to scholastic dogmatics and ethics, under the

guidance of the Sentences of Peter the Lombard, called the "Magister Sententiarum." In modern times, the field has been greatly enlarged by the addition of Oriental philology, biblical criticism, hermeneutics, antiquities, church history and doctrinal history, homiletics, catechetics, liturgics, pastoral theology and theory of church government. No theological faculty is now considered complete without separate professors for the exegetical, historical, systematic and practical branches of divinity. Professors may lecture however, in any department, if not neglecting their immediate duties, Schleiermacher, for instance, taught in turn almost every branch of theology and philosophy.

2d. The Philosophical faculty is by far the most numerous in its teachers and departments; and besides philosophy proper, it embraces history, ancient and modern languages, mathematics, belles lettres. It was formerly called the faculty of Arts (facultas artium liberalium,) whence the terms, Bachelor and Master of Arts.

In the middle ages, all human sciences, as distinct from theology, were divided into seven artes liberales, viz., grammar, rhetoric, dialectics, arithmetic, music, geometry and astronomy.

The first three constituted the Trivium; the remaining four the Quadrivium. The principal text-books in these departments were the dialectical, ethical and physical works of Aristotle, until the Reformation and the philosophy of Bacon and Cartesius deposed the great Stagyrite from his long reign. Since that time, although the historical, philological and natural sciences have made immense progress, the faculties have not kept pace with them, in their reorganization.

The Philosophical study, properly so called, includes logic, metaphysics, philosophy of nature, anthropology and psychology, philosophy of law or political ethics,

philosophy of history, philosophy of art or æsthetics, moral philosophy, philosophy of religion, and history of philosophy.

3d. The faculty of Law (facultas juris canoniciet civilis) embraces a greater variety of studies (especially the history of civil, criminal, and common law, the exposition of the ancient Roman Code, and the canon law) than our own law schools. But on the other hand, these latter, with the many opportunities for public speaking and our republican institutions, produce stronger advocates and more practical statesmen. The German law-schools were modeled after the oldest in the world, that of Bologna.

4. The faculty of Medicine comprehends chemistry, physiology, anatomy, phrenology, pathology and similar sciences, which are taught also in all our regular medical colleges.

The universities of Berlin and Vienna, enjoy the greatest medical reputation.

The system of academical degrees originated likewise in the middle ages. In Germany, the lower degrees have disappeared except for divinity, but the doctorship remains for each faculty. This may be acquired after the completion of the prescribed course, by a special examination, printed dissertation or book and public disputation conducted in Latin; all involving considerable expense. The diploma of Doctor of Philosophy, however, which corresponds somewhat to our Master of Arts, and also that of Doctor of Medicine, can be more easily secured; at least, from several smaller universities. Some years ago, complaint was entered at the Diet of Frankfort against the traffic in the lower diplomas which brought them into disrepute; and the lesser states were compelled to check it. The Prussian universities demand very scrupulously a rigorous examination and public disputation, and never waste a degree honoris causa.

In theology, there are still two degrees, that of the Licentiate (corresponding to the English Bachelor of Divinity), which confers the right of public teaching in the university, and that of D. D. The latter is the highest academic honor and hence much rarer than the doctor's diploma of any other faculty. It may be acquired by the regular process of a written work and Latin debate, in which every member of the university can attack the published theses of the candidate; but it is now generally given honoris causa, as an acknowledgment of distinguished literary merit, or of eminent usefulness in the church.

The Gymnasia, unlike the colleges of England and America, confer no degrees.

There are three classes of teachers in the universities.

1st. The ordinary professors; who are regular members of the faculty and receive a full support from the state independently of the proceeds of their lectures and can be elected to the academical senate and the rectorship.

2d. The extraordinary professors; who have no seat in the faculty nor in the senate, and have a smaller income but are generally promoted to a vacant regular professorship.

3d. The private lecturers (privatim docentes); who have passed through the examen rigorosum and deliver lectures like the regular professors but are without appointment and generally receive no salary from the state. They depend therefore, upon the fees for lectures or private tuition or extra literary labor. Unless they have means of their own or eminent popular talents which attract crowds and secure sometimes a special appropriation from the minister, they drag out a very weary existence.

Most of the professors must pass through these stages before reaching the honor and benefits of a regular or ordinary professorship. Some few distinguished men,

however, are called directly, from the ranks of the ministry or of the law or medicine.

The number of teachers varies from thirty to a hundred and fifty or even more. At Berlin, there are 186 professors for 2435 students; at Vienna, 181 professors for 4608 students; at Munich, 119 for 1213 students; at Gottingen 144 for 711 students; at Leipsic 112 for 1007 students; at Heidelberg, 98 for 850 students; at Bonn, 98 for 935 students; at Breslaw, 101 for 946 students.

One of the most important characteristics of the German university is the professorial or lecture system as distinct from the English tutorial system. Instead of a number of colleges, as in Oxford and Cambridge, where the students live together under moral supervision, one large building with a number of halls (Hörsaal) receives them during a part of the day for the lectures, as they may choose to attend. Attendance is left to their own sense of duty. The studious and conscientious frequent four or five lectures daily. When the clock strikes, they take their seats in the Hörsaal, unfold their portfolios and strike the ink-horn (armed below with a sharp iron spike) into the wooden desk, waiting for the learned oracle. After an intermission of ten or fifteen minutes, the professor ascends the rostrum and with the familiar address, "Meine Herren," begins his lecture standing or sitting, reading or extemporizing or both alternately. Some of the hearers take down in short-hand every word that drops from the mouth of living wisdom. Others show their contempt for goose-quill learning by merely listening or noting the general heads.

The most judicious appropriate the lecture to their mind as it goes on, and reproduce it in a condensed form. If the professor speaks indistinctly, some give him a hint with a motion of their feet, to repeat the sentence. But not all professors pay attention to this linguam pedestrem.

Each lecture lasts about three quarters of an hour till the clock gives its accustomed sound, when the professor folds his manuscript, the students wipe their pens, shut the ink horn, take hat or cap and portfolio and crowd to the door, to return to their lodgings or to attend another lecture or to walk the hospitals or enter the laboratories.

This is generally all the instruction imparted in these institutions. In Berlin and Halle, however, meetings (Seminare) are held in the professors' houses for the discussion of Biblical, and patriotic or of classical authors and for the composition of Latin prize essays.

Thus Neander used to read in this familiar way Tertullian's Apologeticus, Origen's Commentaries and De Principiis, Augustine's Confessions, Chrysostom De Sacerdotio, etc. These meetings are conducted in Latin. In Tubingen, the lecture-system is accompanied by weekly recitations and examinations conducted by the repententen, who may be compared to the tutors or teaching-fellows of British universities.

Until the middle of the eighteenth century, the lectures were all delivered in Latin : a method which was very injurious to the cultivation of the German language. The scholars of the seventeenth century wrote and spoke the classical or the scholastic Latin better than their mother tongue. It was the merit of Thomasius, professor in Halle, that he began the gradual abolition of this pedantry, and introduced the national language ; at present very few lectures are delivered in Latin, while this language is still used very properly in academic dissertations, the conferring of degrees and other public solemnities.

It is easy to see that the lecture system has great advantages both for the professor and the student. The task of writing one or more learned lectures every day, at least early in the professorial career, draws out all the powers

and produces that high scholarship and marvellous literary fertility in which Protestant Germany surpasses all other countries, and by which it furnishes to England and America, directly or indirectly, most of their classical and scientific text books. To the student, this system is generally the most impressive. When a science comes clothed in flesh and blood from the mind and lips of the professor like Minerva from the head of Jove, it inspires the hearer with a consciousness of the creative power slumbering within himself and fires it into action. And the habit of writing, pursued by the student, accompanied by thought is generally the best method of mental appropriation and digestion. But on the other hand, it must be admitted that the German universities promote an excessive individuality of intellect and fertility of opinions; an extreme opposite to the stagnate steadiness, uniformity and traditionalism of Oxford and Cambridge. If the government allow too little political liberty, the universities allow too great intellectual and doctrinal liberty. With a vast amount of invaluable learning and useful systems they have brought forth also many fantastic, absurd and revolutionary theories.

They have been the hot houses of rationalism, skepticism and pantheism, and all sorts of dangerous innovations.

A model university, while affording the widest cultivation of all sciences, should never lose the great aim of benefiting society and of training the rising intellect for practical usefulness in church and state. It should reconcile the claims of authority and of freedom and guard the unity and harmony of truth as well as the diversity and universality of science. The lecture system can and should be combined with the recitation system — thus ascertaining the student's progress, explaining the subject fully and supplying the peculiar needs of each young mind for its future career in life.

The German universities maintain the principle of universal admission both for those who wish to teach and for those who wish to learn, on the sole condition of intellectual capacity. There are no sectarian or religious disabilities, as at Oxford and Cambridge, except for the professorship of the theological faculty. Thus you find among the students Lutherans, Reformed, Roman Catholics, Greeks and even Jews, and many foreigners from all countries of Europe and America. Here they enter an unlimited field of independent study, where they may for four or more years conduct their education and acquire, on examination, an academic degree.

The students have generally passed their eighteenth or twentieth year when they leave the dull routine of the gymnasium. Their sojourn in the university is an era of perfect intellectual freedom, such as they never enjoy in subsequent life. They choose their profession, their professors and the lectures; they may attend them with scrupulous regularity or waste their precious time in idleness and dissipation. They are supposed to possess full intellectual and moral maturity except in politics. The only compulsion to study are the examinations requisite for the Doctor's diploma or for the active service of church and state. But the strongest stimulus is supposed to be an enthusiasm for science and the highest culture.

The universities are not training schools, like the gymnasia and our American colleges, but they represent the unity and universality of scientific knowledge, the field for the presentation and dissemination of truth; and they afford unlimited opportunity for original study and self development. To many a youth, this academical freedom proves disastrous; but the German student is proverbial for his plodding disposition and his unwearying toil. It must be confessed that drinking, duelling (although the

latter is strictly prohibited) and other lawless and vulgar habits still disgrace several of these learned institutions, especially in smaller towns, as Jena and Geissen, where the students hold the citizens or "Philistines," under their control. But with proper allowance for national genius and taste, German students lose nothing by comparison with those of Oxford and Cambridge, while in industry they generally surpass them.

"A German student," says a recent English writer, "does not feather his oar in a university boat or regatta day; he does not kick the foot-ball on Parker's piece; he does not skilfully take the balls at a cricket match.

"These gentle pastimes would not satisfy his bolder and noisier disposition. His thoughts are more excitable and somewhat enthusiastic. His manners are more cordial and unreserved. His appearance and demeanor are less aristocratic. Yet he is well-bred, spirited and high-minded; he is frank and open; a faithful friend and an eccentric lover of his Fatherland. He is a sworn enemy to all falsehood and all deceit. Peculiar notions of honor and a deep love of independence and liberty belong to his most deep-rooted principles. Song and music, social parties, convivial fetes, a martial, undaunted spirit, and excitement of the patriotic feelings throw over his life an enchantment which gilds it yet in all his later recollections."

The students live not in one building, as is generally the case in our colleges, but are scattered through the town. They spend from two to five hours every day in the lecture rooms and the rest of the time in reading and writing at home or in intercourse with their fellow students. The majority, especially the "foxes," as the fresh-men are called, join the social clubs, the members of which generally wear or used to wear peculiar colors on their caps, flags, and breast-bands, and meet on special days at a particular inn or private room. At their meet-

ings, they discuss their professors and sweethearts, arrange a serenade to a favorite teacher or a practical joke upon some sordid landlord or "philister;" they apostrophize Fatherland in patriotic speeches, pour out their hearts in a noisy flow of jolly good-fellowship, with pathos and pipes, lampoons and lager, sarcasm and sausages, shouts of laughter and song till midnight; like the uproarious crew in Auerbach's cellar. It must not be supposed, however, that all share in this boisterous mirth. The steady fellows live in almost ascetic retirement or seek friends of strict moral and literary habits.

"Providence has given to the French the empire of the land, to the English that of the sea, to the Germans that of the air. By this famous saying, Jean Paul, himself a denizen of the air, proclaimed the strength as well as the weakness of his native country; and those critics who in good or ill humor quote it to the disparagement of the Germans, seem to forget that the air is the habitation of the warbling nightingale and the soaring eagle, and is as necessary and useful to man as are the land and the sea; and situated as Germany is, in the heart of Europe, she furnishes the heart's blood, the ideas and principles of modern history and holds the intellectual mastery of the world."

As in times past, she produced the printing-press and the Reformation, the two levers of modern civilization and Christianity, so she reigns at the present day in every department of science and art, and these are, after all, next to virtue and religion, the noblest pursuits and the highest ornaments of immortal man.

In concluding this topic, permit me to say a few words on the transfer of German institutions of learning to American soil. What we need is:

1st. The obligatory education.

2d. More discipline in our schools.

3d. A thorough system of education in all branches.

It needs no argument to show that our college system is incomplete and that we need institutions of the first order, deserving the name of University in the full and proper sense of the term. The day is not distant when this great country will equal any on the globe in every branch of education.

As regards the organization of these future universities, however, we would by no means advocate a slavish copy of the German institutions, but such an adaptation of their features to the peculiar genius of our country, as will make them truly American and a real educational advance upon the old. It has been proposed already to establish such an institution in the city of New York; and it seems to me that we need at least one in every state and territory, to which the colleges will be preparatory like the German gymnasia. These universities ought to be planned on the largest scale, liberally endowed by the states and accessible to all. In these, our national system of education, which has so rapidly advanced of late, would find its necessary and natural completion. If the legislatures neglect this duty, the leading churches or private individuals should assume it. Such a movement would be more consistent with our national genius and would infuse a religious spirit into the institutions, without which they cannot permanently flourish and promote the highest interest of society.

A Course of Instruction.

1. *Primary Schools.*

The general outline of the eight years' course is nearly as follows:

I. First part, of two years, including children from six to eight years old; four principal branches, namely:

1. Logical exercises, or oral teaching in the exercise of the powers of observation and expression, including religious instruction and the singing of hymns.
2. Elements of reading.
3. Elements of writing.
4. Elements of number, or arithmetic.

II. Second part, of two years, including children from eight to ten years old — seven principal branches, namely:

1. Exercises in reading.
2. Exercises in writing.
3. Religious and moral instruction, in select Bible narratives.
4. Language, or grammar.
5. Numbers, or arithmetic.
6. Doctrine of space and form, or geometry.
7. Singing by note, or elements of music.

III. Third part, of two years, including children from ten to twelve years old — eight principal branches, namely:

1. Exercises in reading and elocution.
2. Exercises in ornamental writing, preparatory to drawing.
3. Religious instruction in the connected Bible history.
4. Language, or grammar, with parsing.

5. Real instruction, or knowledge of nature and the external world, including the first elements of the sciences and the arts of life — of geography and history.

6. Arithmetic continued through fractions and the rules of proportion.

7. Geometry—doctrine of magnitudes and measures.

8. Singing and science of vocal and instrumental music.

IV. Fourth part, of two years, including children from ten to twelve years old — six principal branches, namely:

1. Religious instruction in the religious observation of nature; the life and discourses of Jesus Christ; the history of the Christian religion, in connection with the contemporary civil history; and the doctrines of Christianity.

2. Knowledge of the world, and of mankind, including civil society, elements of law, agriculture, mechanic arts, manufactures, etc.

3. Language, and exercises in composition.

4. Application of arithmetic and the mathematics to the business of life, including surveying and civil engineering.

5. Elements of drawing.

6. Exercises in singing, and the science of music.

V. Fifth part, of two years — children from twelve to fourteen.

1. Religious instruction, in the religious observation of nature, the life and discourses of Jesus Christ, the history of the Christian religion, in connection with the cotemporary civil history, and the principal doctrines of the Christian system.

The first topic of instruction mentioned under this head is one of peculiar interest and utility. The pupils are taught to observe, with care and system, the various

powers and operations of nature, and to consider them as so many illustrations of the wisdom, power, and goodness of the Creator; and at each lesson they are directed to some appropriate passage of the Bible, which they read and commit to memory: and thus the idea is continually impressed on them, that the God of nature and the God of the Bible are one and the same Being.

For example, as introductory to the whole study, the first chapter of Genesis, together with some other appropriate passage of Scripture, as the 147th Psalm, or the 38th chapter of Job, may be read and committed to memory.

The surface of the earth, as illustrating the power and wisdom of God, may be taken as a lesson.

Then the varieties of surface, as mountains, valleys, oceans and rivers, continents and islands, the height of mountains, the breadth of oceans, the length of rivers, remarkable cataracts, extended caverns, volcanoes, tides, etc., may be taken into view, and the teacher may impress upon the class the greatness, power, and intelligence necessary for such a creation. The whole is fortified by the application of such a passage as Psalm civ, 1–13.

"Bless the Lord, O my soul! O Lord my God! thou art very great; thou art clothed with honor and majesty. Who coverest thyself with light as with a garment: who stretchest out the heavens like a curtain: who layeth the beams of his chambers in the waters: who maketh the clouds his chariot: who walketh upon the wings of the wind: who maketh his angels spirits; his ministers a flaming fire. Who laid the foundations of the earth, that it should not be removed forever. Thou coverest it with the deep as with a garment: the waters stood above the mountains. At thy rebuke they fled; at the voice of thy thunder they hasted away. They go up by the mountains; they go down by the valleys into the place which thou hast founded for them. Thou hast set a bound that they may not pass over; that they turn not again to cover the earth. He sendeth the springs into the valleys, which run among the hills. They give drink to every beast of the field; the wild asses quench their thirst.

By them shall the fowls of the heaven have their habitation, which sing among the branches. He watereth the hills from his chambers: the earth is satisfied with the fruit of thy works."

"O Lord, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches. So is this great and wide sea, wherein are things creeping innumerable, both small and great beasts. There go the ships: there is that leviathan, whom thou hast made to play therein."

The fruitfulness and beauty of the earth, as illustrating the wisdom and goodness of God, may serve as another lesson. Here may be exhibited the beauty and variety of the plants and flowers with which the earth is adorned; the manner of their growth and self-propagation, their utility to man and beast, their immense number and variety, their relations to each other as genera and species; trees and their varieties, their beauty and utility, their timber and their fruit; and in connection with this lesson, Psalm civ, 14 – 34, may be committed to memory.

"He causeth the grass to grow for the cattle; and herb for the service of man: that he may bring forth food out of the earth; and wine that maketh glad the heart of man, and oil to make his face to shine, and bread which strengtheneth man's heart. The trees of the Lord are full of sap; the cedars of Lebanon, which he hath planted; where the birds make their nests: as for the stork, the fir trees are her house. The high hills are a refuge for the wild goats; and the rocks for the conies. He appointeth the moon for seasons: the sun knoweth his going down. Thou maketh darkness, and it is night: wherein all the beasts of the forest do creep forth. The young lions roar after their prey, and seek their meat from God. The sun ariseth, they gather themselves together, and lay them down in their dens. Man goeth forth unto his work and to his labor until the evening."

"These wait all upon thee; that thou mayest give them their meat in due season. That thou givest them they gather; thou openest thine hand, they are filled with good. Thou hidest thy face, they are troubled: thou takest away their breath, they die, and return to their dust. Thou sendest forth thy Spirit, they are created:

and thou renewest the face of the earth. The glory of the Lord shall endure forever; the Lord shall rejoice in his works. He looketh on the earth, and it trembleth: he toucheth the hills, and they smoke. I will sing unto the Lord as long as I live: I will sing praise to my God while I have my being. My meditation of him shall be sweet: I will be glad in the Lord."

In like manner, the creation and nourishment, the habits and instincts of various animals may be contemplated, in connection with Proverbs, vi, 6–8; Psalm civ, 17–22; Proverbs, xxx, 24–31; Gen. i, 20–24; Psalm cxlv, 15–16.

"Go to the ant, thou sluggard! consider her ways, and be wise: Which having no guide, overseer, or ruler, provideth her meat in the summer, and gathereth her food in the harvest."

"There be four things which are little on the earth, but they are exceeding wise: the ants are a people not strong, yet they prepare their meat in the summer; the conies are but a feeble folk, yet make they their houses in the rocks; the locusts have no king, yet go they forth all of them by bands; the spider taketh hold with her hands, and is in king's palaces. There be three things which go well, yea, four are comely in going: a lion, which is strongest among beasts, and turneth not away for any: a greyhound; a he-goat also; and a king, against whom there is no rising up."

"And God said, Let the earth bring forth the living creature after his kind, cattle, and creeping thing, and beasts of the earth after his kind: and it was so. And God made the beasts of the earth after his kind, and cattle after their kind, and everything that creepeth upon the earth after his kind: and God saw that it was good."

"The eyes of all wait upon thee: and thou givest them their meat in due season. Thou openest thine hand, and satisfiest the desire of every living thing. The Lord is righteous in all his ways, and holy in all his works."

The phenomena of light and color, the nature of the rainbow, etc., may make another interesting lesson, illustrating the unknown forms of beauty and glory which exist in the Divine mind, and which he may yet develop in

other and still more glorious worlds; in connection with Gen., i, 3, 5, 9, 13, 14, and other passages of like kind.

So the properties of the air, wind, and storm, Job, xxviii, 25; xxxviii, 33, 34, 35; Psalm cxlviii, 8.

"Knowest thou the ordinance of heaven? canst thou set the dominion thereof in the earth? Canst thou lift up thy voice to the clouds, that abundance of waters may cover thee? Canst thou send lightnings, that they may go, and say unto thee, Here we are? Who hath put wisdom in the inward parts? or who hath given understanding to the heart? Who can number the clouds in wisdom? or who can stay the battles of heaven?"

Then the heavens, the sun, moon, planets, fixed stars, and comets, the whole science of astronomy, so far as it can be introduced with advantage into common schools, can be contemplated in the same way. The enlightening, elevating, and purifing moral influence of such a scheme of instruction, carried through the whole system of nature, must be clearly obvious to every thinking mind; and its utility, considered merely with reference to worldly good, is no less manifest. The second topic of religious instruction is more exclusively scriptural. The life of Christ, and the history of the apostles, as given in the New Testament, are chronologically arranged, and tables formed as before. (III, 3.) The discourses of Christ are examined and explained in their chronological arrangement, and in the same way the discourses and epistles of the apostles. The history of Christianity, in connection with the cotemporary civil history, is taught in a series of conversational lectures. To conclude the whole course of religious instruction, a summary of the Christian doctrine is given in the form of some approved catechism.

2. Knowledge of the world and of mankind, including civil society, constitutional law, agriculture, mechanic arts, manufactures, etc.

This is a continuation and completion, in a more systematic form, of the instruction commenced in III, 5. The course begins with the family, and the first object is to construct a habitation. The pupil tells what materials are necessary for this purpose, where they are to be found, how brought together and fitted into the several parts of the building. The house must now be furnished. The different articles of furniture and their uses are named in systematic order, the materials of which they are made, and the various trades employed in making them are enumerated. Then comes the garden, its tools and products, and whatever else is necessary for the subsistence and physical comfort of a family. Then the family duties and virtues; parental and filial obligation and affection; rights of property: duties of neighborhoods; the civil relations of society; the religious relations of society; the state, the father-land, etc.; finally, geography, history, and travels. Books of travels are compiled expressly for the use of schools, and are found to be of the highest interest and utility.

3. Language, and exercises in composition.

The object here is to give the pupils a perfect command of their native tongue, and ability to use it on all occasions with readiness and power. The first exercises are on simple questions, such as, "Why ought children to love and obey their parents?" or they are short descriptions of visible objects, such as a house, a room, a garden, etc. There are also exercises on the various forms of expressing the same idea, as, "The sun enlightens the earth." "The earth is enlightened by the sun." "The sun gives light to the earth." "The earth receives light from the sun." "The sun is the source of light to the earth." "The sun sends out its rays to enlighten the earth." "The earth is enlightened by rays sent out from the sun," etc. There are exercises also of the same sort on metaphors and other figures of speech. Familiar letters are

then written, and short essays on themes such as may be furnished by texts from the Book of Proverbs, and other sentences of the kind; and thus gradual advancement is made to all the higher and graver modes of composition.

4. Application of arithmetic and the mathematics to the business of life, including surveying, civil engineering, etc.

The utility of this branch of instruction, and the mode of it, after what has already been said, are probably too obvious to need any further illustration.

5. Elements of drawing.

For this the pupils have already been prepared by the exercises in ornamental writing, in the previous part of the course. They have already acquired that accuracy of sight and steadiness of hand which are among the most essential requisites to drawing well. The first exercises are in drawing lines, and the most simple mathematical figures, such as the square, the cube, the triangle, the parallelogram; generally from wooden models, placed at some little distance on a shelf, before the class. From this they proceed to architectural figures, such as doors, windows, columns, facades. Then the figures of animals, such as a horse, a cow, an elephant; first from other pictures, and then from nature. A plant, a rose, or some flower is placed upon a shelf, and the class make a picture of it.

From this they proceed to landscape painting, historical painting and the higher branches of the art, according to their time and capacity. All learn enough of drawing to use it in the common business of life, such as plotting a field, laying out a canal, or drawing the plan of a building; and many attain to a high degree of excellence.

6. Exercises in singing and the science of music.

The instructions of the previous parts are extended as far as possible, and include singing and playing at sight, and the more abstruse and difficult branches of the science and art of music.

In Bavaria, Wirtemburg, the Duchy of Baden and Nassau, as much, and in Wirtemburg and Baden, perhaps even more, has been done to promote the intelligence, morality, and civilization of the lower orders of society, than in Prussia. In each of these countries, every village has a good school-house, and at least one learned and practically efficient teacher, who has been educated for several years at a college; every town has several well-organized schools, sufficiently large to receive all the children of the town, who are between the ages of six and fourteen; each of these schools contains from four to ten class-rooms, and each class-room is under the direction of a highly educated teacher.

In each of these countries, every parent is obliged to educate his children, either at home or at some school, the choice of means being left to himself. In none of these countries are children left to grow up in vicious ignorance or with debasing habits.

In none of these countries, is there any class of children analogous to that which swarms in the back streets, alleys and gutters of our great cities and towns, and from which, our paupers, our disaffected, and our criminals grow up, and from which our "ragged schools" are filled. All the children are intelligent, polite, clean, and neatly dressed, and grow up from their sixth to their fourteenth year under the teaching and influence of educated men.

In each of these countries a sufficient number of normal colleges has been founded, to enable it to educate a sufficient supply of teachers for the parishes and towns.

In each of these countries, all the schools of every sect and party, private as well as public, are open to public inspection, and are visited several times every year by learned men, whose business it is to examine both teachers and scholars, and to give the government, the chambers, and the country, a full and detailed account of the state,

condition, character, and progress of every school, so that parents may know where to send their children with safety; that good teachers may be encouraged, rewarded, and promoted; and that unworthy teachers may not be suffered to continue long in their situations.

In each of these countries, the laws prohibit any person being a teacher of any school, until he has proved his efficiency to the committee of professors, appointed by the state to examine candidates, and until he has laid before such committee testimonials of character from his religious minister, his neighbors, and the professors of the college at which he was educated.

2. *Burger or Middle Schools.*

Religious Instruction.

Class VI. Four hours per week. Narration by the teacher of stories from the Old Testament, in the words of the Bible, repeated by the pupils. Easy verses learned by heart.

Class V. Four hours. Stories from the gospels, except the latter portion of the life of Christ. Church songs and Bible verses learned.

Class IV. Three hours. The Old Testament in a more connected form. The moral of the history is impressed upon the children. The Ten Commandments and church songs committed to memory.

Class III. Two hours. The life and doctrines of Christ, to the period of his imprisonment. Church history. Four weeks are set apart for learning the geography of Palestine.

Class II. Two hours. The Protestant catechism committed to memory and explained. Church songs and verses committed.

Class I. Two hours. A compendium of the history of the Christian Church, particularly after the apostolic age. History of the Reformation. Review of the Bible. Committing to memory psalms and hymns continued.

GERMAN LANGUAGE.

Class VI. Four hours. Exercises of speech. Stories narrated to the children and repeated by them. After learning to write, these stories are written upon the slate.

Class V. Four hours. Exercises in orthography. Etymology begun.

Class IV. Four hours. Exercises in orthography and style. Every week a short composition is written on some subject which has been narrated.

Class III. Grammar continued.

Class II. Four hours. Original compositions, which are corrected during the recitations. Syntax commenced.

Class I. Three hours. Compositions on historical subjects. Essays written at home, and corrected in the class-room. Syntax continued.

LATIN LANGUAGE.

Class IV. Three hours. Declensions of nouns, adjectives, and pronouns learned. Examples learned by heart, and others written as an exercise at home. Auxiliary verbs conjugated.

Class III. Four hours. Comparison of adjectives. Regular verbs conjugated.

Class II. Four hours. Irregular verbs. Syntax begun. Translation from Latin into German.

Class I. Six hours. Grammar continued. Written exercises at home and in the class. Every four weeks an extempore exercise is written, which the teachers correct out of school hours. Cornelius Nepos read and construed.

French Language.

Class III. Three hours. Exercises in reading. Elements of grammar. Words learned by heart. Easy exercises written at home and in school hours.

Class II. Four hours. Regular and irregular verbs learned. Syntax. Translations from French into German. Words learned by rote.

Class I. Four hours. Written exercises of increased difficulty. Tables dictated and learned by heart. Voltaire's Charles XII read.

Arithmetic.

Class VI. Four hours. Practical arithmetic. The fundamental operations taught with numbers from one to one hundred; first mentally, then with blocks, and afterward with figures. Exercises prepared at home twice a week.

Class V. Four hours. The four ground rules continued, with numbers as high as one thousand. Exercises in reading and writing large numbers. Mental arithmetic especially practiced. Addition and subtraction of abstract numbers.

Class IV. Four hours. Addition and subtraction revised. Multiplication and division of abstract numbers. Weights and measures explained.

Class III. Four hours. The four ground rules with fractions.

Class II. Three hours. Revision of the above. Rule of three.

Class I. Three hours. In the first year practical arithmetic finished. Proportions and decimal fractions. Elements of algebra. Mental algebra.

GEOMETRY.

Class IV. Two hours. The essential preparatory exercises in form, in connection with drawing. Rudiments explained.

Class III. Two hours. Practice in the position of points, drawing of lines, angles, plane figures, representations of solids.

Class II. Two hours. Elements of geometry proper, the point, line, angles, triangles, and measures of straight lines, surfaces, and contents.

Class I. Two hours. Plane geometry completed, with practical exercises. Every alternate six months, lessons in physics are given.

NATURAL HISTORY.

Class II. Two hours. In the summer term, study of certain classes of plants. In the winter term, of animals. The subject is illustrated by drawings.

Class I. Two hours. Systematic botany during the winter term, and zoology and mineralogy during the winter.

GEOGRAPHY.

Class III. Two hours. Knowledge of home. Berlin and its environs. Regency of Potsdam. Province of Brandenburg. Necessary technical terms explained, as horizontal, vertical, etc.

Class II. Two hours. Geography of Prussia and Germany.

Class I. Two hours. General geography, particularly Europe and America. Asia more generally, Africa and Australia very briefly.

HISTORY.

Class II. Two hours. View of universal history, biographical rather than chronological.

Class I. Two hours. First year universal history completed. Second year the history of Germany, and particularly of Prussia. The most important inventions and discoveries are noticed in connection with the history of these countries.

READING.

Class VI. Seven hours. Reading by the phonic (lautir) method. Analysis of words in regard to division into syllables and sounds.

Class V. Seven hours. Mechanical reading continued, but with reference to the meaning of the words. The pupils are examined upon words, sentences, and paragraphs.

Class IV. Four hours. Explanatory reading continued Accentuation. No piece is allowed to be read without it being understood.

Class III. Two hours. Rythmical reading begun. Interesting portions of the matter read, narrated by the pupils in their own words.

Class II. Two hours. Rythmical reading continued.

Class I. Two hours. Reading of some of the German classics. Analysis of the subject read.

WRITING.

Class VI. Five hours. Introductory exercises of drawing upon the slate. Copying the small letters from the blackboard. Writing on paper. Capital letters. Written exercises at home twice a week.

Class V. Five hours. Writing of German characters continued. Roman letters begun. Copying from a book at home, with special reference to orthography.

Class IV. Four hours. Writing in German and Roman characters continued. Two hours copying from copy-slips. Two hours writing from dictation.

Class III. Three hours. Exercises of Class IV, continued. Pupils who write well are allowed to write without lines. Writing without copies, according to progress.

Class II. Two hours. Exercises continued. Most of the pupils write without lines, or by directing points merely.

Class I. The written exercises in other departments are examined, to ascertain the character of the handwriting. No special lessons are given.

DRAWING.

Class IV. Two hours. Drawing straight lines in various directions and of various lengths. Making definite angles. Drawing triangles, squares, and other rectilinear figures.

Class III. Two hours. Drawing of circles and ovals.

Class II. Two hours. Drawing of bodies bounded by planes and straight lines in perspective. Drawing of curves.

Class I. Drawing from natural objects, from plaster casts and models.

SINGING.

Class IV. Two hours suffice to learn fifteen or twenty songs, of one or two verses, by note, and some ten choral songs.

Class III. Two hours. Songs with two parts continued. Chorals with one voice.

Class II. Two hours. Songs with two or three voices continued.

Class I. Two hours. Songs and chorals with three or four parts.

Once during the morning there is an interval for recreation in the court-yard of the school, and the pupils are directed in their exercises of marching and counter-marching, and the like, by one of the teachers.

The course marked out in the foregoing programme, as far as it extends, seems to me well adapted to educate the

moral and intellectual faculties, as well as the senses; to give mental vigor, while it furnishes information useful to the pupil in after life.

3. *Teacher's Seminary.*

The following table will show what the subjects of instruction are:

TIME TABLE IN TEACHERS' COLLEGE IN DRESDEN.

Summer Half Year. Number of hours each Week in Class.			Winter Half Year. Number of hours each Week in Class.			CLASSES.
I.	II.	III.	I.	II.	III.	
2	2	2	2	2	2	1. Religion.
0	1	1	2	1	1	2. Explanation of the Scriptures.
0	1	1	0	1	1	3. Scripture history.
3	1	1	3	0	0	4. Catechism.
1	0	0	1	0	0	5. Religious exhortation.
2	0	0	2	0	0	6. Pedagogy.
0	3	3	0	3	3	7. Special methods of teaching.
2	1	1	2	0	0	8. I. Rhetoric and reading exercises; II and III. Mental calculations.
1	1	1	1	1	1	9. Recitation.
2	0	0	2	0	0	10. Natural philosophy.
0	2	2	0	2	2	11. Natural history.
0	1	1	0	1	1	12. Geography.
1	0	0	0	0	0.	13. Mathematical geography.
1	1	1	1	1	1	14. History.
1	2	2	1	2	2	15. German language.
2	0	0	2	0	0	16. Latin language.
2	2	2	2	2	2	17. Writing.
?	2	1	2	2	2	18. Arithmetic.
0	1	2	0	0	0	19. Geometrical drawing.
1	0	0	1	1	1	20. Geometry.
2	2	2	2	2	2	21. Drawing.
0	0	1	1	1	2	22. Singing.
1	1	1	1	1	1	23. Choral singing.
1	1	0	0	0	0	24. Quartet singing.
2	2	2	2	2	2	25. Concert singing.
6	3	2	3	1	6	26. I. Organ playing. II and III. Violin playing.
13	19	19	7	12	6	27. Preparation and exercise hours.
2	2	2	2	2	2	28. Gymnastic exercises.
52	51	50	42	40	40	Total number of hours per week.

The students rise in summer at 5 o'clock, and in winter at 6 o'clock, in the morning: as soon as they are dressed, they meet in one of the class-rooms, where the director reads the morning prayers; their hours of study are from 7 to 12 A. M. and from 2 to 5 P.M.

Connected with the college is a primary school for children of that district of the city, in which the college is situated: this school is under the direction of a regularly appointed and experienced teacher, and is attended by 105 children, who are divided into three classes, to each of which is assigned a separate class-room in one part of the college buildings. In these classes, a certain number of students from the college first practice teaching under the eye, and aided by the advice of the teacher.

At the end of this long and careful preparation, they are called before the board of examiners. If the young man is a Protestant, his religious examination is conducted by the board of examiners themselves; but if he is a Romanist, a priest is joined to the board, and conducts the religious part of the examination.

The examination lasts three days. On the first day the subjects are —

From 1 to 10 o'clock, A. M., Scripture history.
" 10 to 12 " " Pedagogy.
" 2 to 4 " P. M., Mathematics and the theory of music.

The answers to the questions of the first day's examination are given in writing. On the second day the subjects are—

From 7 to 11 o'clock, A. M., { Catechising a class of village school children on some subject of elementary instruction.

" 11 to 12 " " { Reading;
Arithmetic; and
An object lesson given to school children.

From 1 to 2 o'clock P. M., { A *vivâ voce* examination—
In religion;
The Scriptures;
Luther's catechism; and
Pedagogy.

" 4 to 5 " " { German language;
Logic; and
Psychology.

" 5 to 6 " " { History;
Geography;
Natural philosophy; and
Natural history.

On the third day the subjects of examination are —

Organ playing;
Singing;
Piano-forte; and
Violin.

If the young candidate, who had been educated for four years in a teachers' college, can not pass this examination so as to satisfy the examiners, he is obliged to continue his studies until he can do so. But if he passes the examination in a satisfactory manner, the examiners grant him a diploma, which is marked "excellent," "good," or "passable," according to the manner in which he acquitted himself in his examination.

If the young candidate does not obtain a certificate marked "excellent," but only one marked "good," or "passable," he can not officiate as teacher, until he has spent two years in some school as assistant to an experienced teacher.

At the end of this time, he is obliged again to present himself to the board of examiners, who examine him again in the most careful and searching manner. If he passes this examination, he receives another diploma marked "excellent," "good," or "passable," according to his merit, and if he obtains a diploma marked "excellent," he is enrolled among the members of the teachers' profession,

and is allowed to officiate either as a private tutor or as a village teacher. But if he can not obtain this diploma, he is obliged to continue to act as an assistant teacher until he can do so. Seminar Director Dr. Otto, the principal of the normal college, and a member of the board of examiners, assured me, that it was a common thing for candidates to be examined four or five times, before they succeeded in obtaining a teachers' diploma. When they have at last succeeded, they, as well as those who obtained the diploma marked " excellent " in the first examination, are eligible as teachers.

The school committee of the different parishes elect their own teachers. The only condition, to which this right is subjected is, that they may not elect any person, who has not obtained a diploma of competence from the board of examiners.

4. *City Trade School.*

The City Trade School is to give a more appropriate education for the mechanic arts and higher trades then can be had through the courses of classical schools. It is a great point gained, when the principle is admitted that different kinds of education are suited to different objects in life; and such an admission belongs to an advanced stage of education. As a consequence of a general sentiment of this kind, numerous schools for the appropriate instruction of those not intended for the learned professions grow up by the side of the others.

THIRD CLASS.

Physics. Electricity and magnetism, with experiments. Two hours. Chemistry. Water and non-metallic bodies with experiments. Two hours.

Writing. Two hours. Architectural and topographical drawing. Two hours. Some of the pupils during this time are engaged in ornamental drawing.

Vocal music. Two hours.

Second Class.

Religious Instruction. Explanation of the first three gospels. History of the Christian religion and church to the reformation. Two hours.

German. Correction of exercises written at home, upon subjects assigned by the teacher. Oral and written exercises. Introduction to the history of German poetry. Three hours.

French. Grammar; extemporalia for the application of the rules. Written and oral translations from German into French, from Beauvais's Manual, and vice versa, from Ideler and Nolte's Manual. Four hours.

English. Exercises in reading and speaking. Translation into German, from Burkhardt. Dictation. Verbs. Two hours.

Arithmetic. Commercial Arithmetic. Algebra, to include simple and quadratic equations. Logarithyms. Three hours.

Geometry. Circles. Analytical and plane trigonometry. Three hours.

Geography. The states of Europe, with special reference to their population, manufactures and commerce. Two hours.

History. Principal events of the history of the middle ages and of later times, as an introduction to recent history. One hour.

Natural History. Mineralogy. Physiology of plants. Three hours.

Chemistry. Metallic bodies and their compounds, with experiments. Three hours.

Architectural, topographical, and plain drawing. Drawing with instruments. Introduction to India ink drawing. Beginning of the science of construction. Two hours.

Drawing. From copies, and from plaster and other models. Two hours. This kind of drawing may be learned instead of the above.

Vocal music. Two hours.

First Class.

Religious Instruction. History of the Christian religion and church continued. References to the Bible. One hour.

German. History of German literature to recent times. Essays. Exercises of delivery. Three hours.

French. Reading from the manual of Buchner and Hermunn, with abstracts. Classic authors read. Review of grammar. Exercises at home, and extemporalia. Free delivery. Correction of exercises. Four hours.

English. Syntax, with written and extempore exercises from Burkhardt. Reading of classic authors. Writing of letters. Exercises in speaking.

Arithmetic. Algebra. Simple and quadratic equations. Binomial and polynomial theorems. Higher equations. Commercial arithmetic continued. Three hours.

Geometry. Plane trigonometry and its applications. Conic sections. Descriptive geometry. Three hours.

History. History of the middle ages. Modern history with special reference to the progress of civilization, of inventions, discoveries, and of commerce and industry. Three hours.

Natural History. In summer, botany, the principal families, according to the natural system. In winter, zoology. The pupils are taken, for the purpose of examining specimens, to the Royal Museum.

Physics. In summer, optics with experiments. In winter, the system of the world. Three hours.

Technology. Chemical and mechanical arts and trades, described and illustrating by models. Excursions to visit the principal workshops. Four hours.

Architectural and machine drawing. Two hours. those pupils who do not take part in this, receive lessons in ornamental drawing from plaster models.

Vocal music. Two hours.

The pupils of this class are, besides, engaged in manipulating in the laboratory of the institution several hours each week.

The facilities for the courses are furnished by a collection of mathematical and physical apparatus, a laboratory, with a tolerably complete chemical apparatus and a series of tests, a collection of specimens of the arts and manufactures (or technological collection) a collection of dried plants, and of engravings for the botanical course, and a small garden for the same use, a collection of minerals, a collection of insects, a collection in comparative anatomy, a series of engravings for the drawing course, and of plaster models, a set of maps, and other apparatus for geography, some astronomical instruments, and a library. The pupils are taken from time to time, to the admirable museum attached to the university of Berlin, for the examination of zoological specimens especially.

5. *Royal Real Schools.*

The Royal Real School of Berlin was founded as early as 1747, by Counsellor Hecker. At the period in which this school was founded, Latin and Greek were the exclusive objects of study in the learned schools, and the avowed purpose of this establishment was that "not mere words

should be taught to the pupils, but realities, explanations being made to them from nature, from models and plans, and from subjects calculated to be useful in after-life." Hence the school was called a "real school," and preserves this name, indicative of the great educational reform which it was intended to promote, and the success of which has been, though slow, most certain.

In the Royal Real School the branches of instruction are — religion, Latin, French, English, German, physics, natural history, chemistry, history, geography, drawing, writing, and vocal music. The Latin is retained as practically useful in some branches of trade, as in pharmacy, as aiding in the nomenclature of natural history, and as preventing a separation in the classes of this school and that of the gymnasium, which would debar the pupils from passing from the former to the latter in the upper classes. It must be admitted that, for all purposes but the last, it occupies an unnecessary degree of attention, especially in the middle classes.

The following table shows the distribution of time among the courses. There are seven classes in numerical order, but ten, in fact, the third, fourth, and fifth being divided into two ; the lower fourth is again, on account of its numbers, subdivided into two parallel sections. Of these the seventh, sixth, and fifth are elementary classes, the pupils entering the seventh at between five and seven years of age. In the annexed table the number. of hours of recitation per week of each class in the several subjects is stated, and the vertical column separating the elementary classes from the others, contains the sum of the hours devoted to each branch in the higher clases, excluding the lower section of the fourth class, which has not a distinct course from that of the other division.

TABLE SHOWING THE NUMBER OF HOURS OF RECITATION PER WEEK, OF EACH CLASS, IN THE SUBJECTS TAUGHT IN THE ROYAL REAL SCHOOL OF BERLIN.

SUBJECTS of STUDY.	First Class.	Second Class.	Third Class, A.	Third Class, B.	Fourth Class, A.	Fourth Class, B. I. / Fourth Class, B. II.		Sum of the hours in the seven upper classes.	Fifth Class, A.	Fifth Class, B.	Sixth Class.	Seventh Class.	Proportion of other studies to German in the		
													Royal Real School.	First six classes of the Frederick Wm. Gymn.	In all the classes of the Frederick Wm. Gymn.
Latin,.....	4	4	4	5	6	5	6	28					1.4	2.9	3
French,.....	4	4	4	3	3	4	4	22	4	5			1.1	0.7	0.9
English,.....	2	2	2					6					0.3		
German,.....	3	3	3	4	3	4	4	20	8	8	10	10	1.0	0.8	1.0
Religion,.....	2	2	2	2	2	2	2	12	2	3	2	2	0.6	0.6	0.8
Mathematics,*...	6	6	5	6	7	6	4	35	4	3	6	6	1.7	1.1	1.6
Natural History,..	3	2	2	2				9					0.4	0.1†	0.1
Physics,.....	2	2	2	2				8					0.4	0.2†	0.2
Chemistry,.....	2	2	2	2				8					0.4		
Geography,.....				3	3	3	3	9	2	2	2		0.4	0.5	0.5
History,.....	3	3	3	2	2	2	2	15	2	2	2		0.7	0.3	0.7
Drawing,.....	2	2	2	2	2	2	2	12					0.6	0.4	0.4
Writing,.....					2	2	2	4	4	4	6	8	0·2	0.3	0.3
Singing,.....	2	4	3	2	2	2	2	15					0.7	0.6	0.6
Total,....	36	36	35	35	32	32	32		26	26	26	26			

Pupils who enter this school between five and seven years of age, and go regularly through the elementary classes, are prepared at ten to pass to its higher classes, or to enter the lowest of the gymnasium. It is thus after the fifth class that a comparison of the two institutions must begin. The studies of the real school proper, and of the gymnasium, have exactly the same elementary basis, and they remain so far parallel to each other that a pupil, by taking extra instruction in Greek, may pass from the lower third class of the former to the lower third of the latter. This fact alone is sufficient to show that the real

* Including arithmetic, geometry, and trigonometry.

† These numbers include the entire course.

schools must be institutions for secondary instruction, since the pupils have yet three classes to pass through after reaching the point just referred to. It serves also to separate the real schools from the higher burgher schools, since the extreme limit of the courses of the latter, with the same assistance in regard to Greek, only enables the pupil to reach the lower third class of the gymnasium. In general, a pupil would terminate his studies in the real school at between sixteen and eighteen years of age. The difference between the subjects of instruction in the real school and the Frederick William gymnasium, consists in the omission in the former of Greek, Hebrew, and philosophy, and the introduction of English and chemistry. The relative proportions of time occupied in the same subjects in the two schools, will be seen by comparing the two columns next on the right of the numbers for the seventh class, in the table just given. The first of these columns contains the proportion of the number of hours per week devoted to the different subjects in the six classes of the real school above the elementary, the number of hours devoted to the German being taken as unity; and the second, the same proportion for six classes of the gymnasium, beginning with the lowest, the same number of hours being taken as the unit, as in the preceding column.

6. *Frederick William Gymnasium of Berlin.*

The numbers attached to the names of the different classes, in the following programme, show the number of hours of study per week in the regular branches in which the division of classes takes place. In like manner, the numbers attached to the several subjects of study show how many hours are occupied per week in each of the subjects by the several classes.

Sixth Class, Thirty Hours.

Latin. Inflections of nouns, etc. Comparisons. Conjugation of the indicative moods of regular and of some irregular verbs. Translation from Blume's elementary book. Exercises from Blume. Extemporalia. Ten hours.

German. Etymology and syntax. Exercises in writing upon subjects previously narrated. Exercises in orthography, reading and declaiming. Four hours.

French. Etymology, to include the auxiliary verbs, in Herrmann's grammar. Oral and written exercises. Reading and translation. Exercises on the rules from the grammar. Three hours.

Religion. Bible history of the Old Testament. Committing to memory selected verses. Two hours.

Geography. Delineation of the outlines of Europe, Africa, Asia, and America, from determinate points given. Divisions of the countries, with their principal cities, rivers and mountains. Two hours.

Arithmetic. The four ground rules, with denominate whole numbers. Their applications. Four hours.

Writing. Elements of round and running hand. Dictation. Writing from copy slips. Three hours.

Drawing. Exercises in drawing lines. Two hours.

Fifth Class, Twenty-Nine Hours.

Latin. Etymology. Use of the prepositions. The accusative before an infinitive, practiced orally and in writing, and extempore, and in exercises. Translation from Blume's reader. Ten hours.

German. Parsing, reading and declamation. Exercises on narrations. Four hours. French. Etymology, by oral and written exercises. Easier stories from Hermann's reader. Three hours.

Religion. Explanation of the gospels, according to St. Matthew and St. Luke. Committing to memory the

principal facts. Two hours. Geography. Review of the last year's course. Rivers and mountains of Europe, and chief towns, in connection. Two hours.

Arithmetic. Review of the preceding. Fractions. Four hours.

Writing. Running hand from copy slips. Two hours.
Drawing. Drawing from bodies, terminated by planes and straight lines. Two hours.

Fourth Class, Twenty-eight Hours.

Latin. Review of etymology. The principal rules enforced by oral and written exercises and extemporalia. Translation from Jacob's reader and Corn. Nepos. Ten hours.

German. Compositions on subjects previously read. Declamation. Reading from Kalisch's reader. Parsing. Three hours.

French. Review of etymology. Irregular verbs. Reciprocal verbs. Anecdotes and narrations from Hermann's grammar, and committing the principal to memory. Two hours.

Religion. Gospel according to St. Matthew, explained. Verses and psalms committed to memory. Two hours.

Geography. Political geography of Germany, and of the rest of Europe. Review of the geography of the other parts of the world. Three hours.

Arithmetic. Review of fractions. Simple and compound proportion. Partnership. Simple interest. Three hours.

Geometry. Knowledge of forms, treated inductively. One hour.

Writing. Running hand, from copy slips. Two hours.

Drawing. From bodies bounded by curved lines. Two hours.

LOWER THIRD CLASS, THIRTY HOURS.

Latin. Syntax. Rules of cases from Zumpt. Exercises and extemporalia. Inflections formerly learned reviewed. Cornelius Nepos. Eight hours.

Greek. Etymology, from Buttmann's grammar to regular verbs, included. Translations from Greek into German from Jacob's, from German into Greek from Hess's exercises. Six hours.

German. Compositions in narration and description. Declamation. Two hours.

French. Repetition of inflections, and exercises by extemporalia and in writing. Translation of the fables from Herrmann's reading-book, 2d course. Two hours.

Religion. Morals, and Christian faith. Two hours.

Geography. Physical geography. Europe and the other parts of the world. Two hours.

History. General view of ancient and modern history. Two hours.

Mathematics. Legendre's geometry, book 1. Decimals. Algebra. Square and cube root. Four hours.

Drawing. Introduction to landscape drawing. Two hours.

UPPER THIRD CLASS, THIRTY HOURS.

Latin. Division 1. Syntax, from Zumpt. Review of the preceding course. Oral exercises in construction of sentences. Written exercises and extemporalia. Cæsar Bell. Gall., books 1, 2, and 7, in part. Ovid's Metamorphoses, extracts from books 7 and 8. Prosody, rules from Zumpt. Ten hours.

Greek. Division 1. Etymology, from Buttmann's grammar. Oral and written exercises and extemporalia. Jacob's reader. Six hours.

German. Examination of exercises on historical subjects. Poetical selections for declamation. Two hours.

French. Exercises in translation. Written exercises. Extemporalia. Two hours.

Religion. Principal passages from the gospels gone over. General view of the Old Testament writings. Two hours.

History and Geography. Roman history from the Punic Wars to the destruction of the western empire. History of the middle ages, three hours. Review of the five general divisions of the world, one hour. Four hours.

Mathematics. Geometry. Legendre, books 1 and 2, and part of 3. Algebra, with exercises from Meyer Hirsch. Four hours.

Lower Second Class, Thirty-one Hours.

Latin. Extracts from Livy and Cæsar de Bell. Civ. Review of Bell. Gall., books 2 and 3. Syntax. Exercises and extemporalia. Committing to memory exercises from Livy and Cæsar. Ovid's Metamophoses, books 11 to 14. Eight hours.

Greek. Homer's Odys., 11 12, 13, and 14. Exercises on the dialects. Xenophon's Anab., 1, 2, and, part of 3. Excerpts from the grammar reviewed. Exercises and extemporalia. Syntax. Six hours.

Hebrew. Grammar, ending with irregular verbs. Easier parts of historical books of Scripture translated. Vocabulary learned by rote. Exercises on regular and irregular verbs out of the recitation room. Two hours.

German. Correction of written exercises and essays. Exercises on delivery. Two hours.

French. Voltaire's Charles XII. Exercises and extemporalia. Two hours.

Religion. Explanation of the principal parts of the Epistles of St. Paul, with historical sketches, and a view of the life of early Christian communities. Two hours.

History. Roman history, from the Punic Wars. History of the middle ages concluded. General view of history. Three hours.

Mathematics. Geometry to proportions and simple figures. Elements of algebra. Logarithms. Four hours.

Natural History. Mineralogy. Botany, especially of native plants. Two hours.

Upper Second Class, Thirty-two Hours.

Latin. Cicero's Orations, pro. Rosc. Amer., de Amic., de Senectute. Livy, books 22 to 25, inclusive. Virgil's Æneid, books 1 and 2. Some eclogues and excerpts from Georgics. Exercises and extemporalia. Nine hours.

Greek. Homer's Iliad, books 4 to 11, inclusive. Arrian Alex. expedition, books 1 and 2. Buttmann's grammar with exercises and extemporalia. Six hours.

Hebrew. Books of Judges and of Ruth, with exercises of syntax. Easy exercises, and committing vocabulary to memory out of the class-room. Two hours.

German. Essays. Delivery. Two hours.

French. Excerpts from Harmann and Brüchner's manual of the more recent French literature. Two hours.

Religion. Christian faith and morals. Two hours.

History. Review of ancient history and geography, using the Latin language. Three hours.

Mathematics. Arithmetical geometry and plane trigonometry. Algebraic exercises. Polygons. Stereometry. Simple and quadratic equations. Four hours.

Physics. General physics. Electricity and magnetism. Two hours.

First Class, Thirty-one Hours.

Latin. Horace's Odes, books 3 and 4. Cicero against Verres. Tacitus Annals, books 11 and 12, and extracts from 3 to 6. Cicero, Tusc. quest. Extempore translations from German into Latin. Exercises. Declamation. Eight hours.

Greek. Homer's Iliad, book 16, Odyssey, books 9 to 16, inclusive. Hippias Major, Charmides and Gorsias of Plato, (excerpts.) Sophocles' Edip. tyr. and Antigone. Grammatical exercises. Buttmann's grammar. Six hours.

Hebrew. Second book of Kings. Genesis. Psalms, 16 to 100. Grammatical criticisms of historical excerpts, or of psalms, as an exercise at home. Two hours.

German. Criticism of compositions. General grammar, and history of the German grammar and literature. One hour.

French. Selections from Scribe and Delavigne. Exercises and extemporalia. Two hours.

Religion. History of the Christian church, to the times of Gregory VII. Two hours.

History. Modern history, and review. Three hours.

Mathematics. Plane trigonometry and application of algebra to geometry. Algebra. Mensuration and conic sections. Binomial theorem. Exponential and trigon. functions. Four hours.

Physics. Physical geography. Mechanics. Two hours.

Philosophy. Propædeutics. Logic. One hour.

There are five classes for vocal music, the fifth receiving two hours of instruction in musical notation and singing by ear. The fourth, time and cliffs, etc. Exercises in the natural scale and harmony. Songs and chorals with one part. The third, two hours formation of the scale of sharps, running the gamut with difficult intervals, combined with the practical exercises of the last class. The second, two hours, repetition of tones; sharps, and flats. Formation of the scale of flats. Exercises of songs and chorals, in two parts. The first class is an application of what has been learned, as well as a continuation of the science and art, and all the pupils do not, of course, take part in this stage of the instruction. The course is of four hours per week, two for soprano and alto, one for tenor and bass, and one

for the union of the four parts. The proficiency is indicated by the fact, that the pupils perform very creditably such compositions as Haydn's *Creation* and Handel's *Messiah.*

6. *Institute of Arts of Berlin..*

Winter Course.

Monday. First Class, first division — drawing and sketching machines, eight A. M. to twelve o'clock. Discussion of machines, estimates of power, etc., two P. M. to five P. M. Second division — machine drawing, eight to ten. Modeling in clay, ten to twelve. Physics, two to five.

Second Class. Machine drawing, eight to ten. Modeling, ten to twelve. Elements of geometry, two to four. Repetition of the lecture, four to five.

Tuesday. First Class, first division — architectural plans and estimates, eight to twelve. Practical instruction in machinery, two to five. Second division — ornamental and architectural drawing, eight to twelve. Trigonometry, two to five.

Second Class. Ornamental and architectural drawing, eight to twelve. Physics, two to four. Repetition of the lecture, four to five.

Wednesday. First Class, first division — original designs, eight to twelve. Discussion of machinery. Second division — mineralogy, eight to nine. Machine drawing, nine to twelve. Trigonometry, two to five.

Second Class. Machine drawing, eight to twelve. Practical arithmetic, two to five.

Thursday. First Class, first division — drawing and sketching machines, eight to twelve. Architectural instruction, estimates, two to five. Second division — decorative and architectural drawing, eight to ten. Modeling in clay, ten to twelve. Trigonometry, two to five.

Second Class. Decorative and architectural drawing, eight to ten. Modeling in clay, ten to twelve. Physics, two to four. Repetition of the lecture, four to five.

Friday. First Class, first division — architectural plans, eight to twelve. Practical instruction in machinery, two to five. Second division — machine drawing, eight to twelve. Physics, two to five.

Second Class. Machine drawing, eight to twelve. Elementary mathematics, two to four. Repetition of the lessons, four to five.

Saturday. First Class, first division — perspective and stone-cutting, eight to twelve. Original designs, two to five. Second division — mineralogy, eight to nine. Decorative and architectural drawing, nine to twelve. Trigonometry, two to five.

Second Class. Decorative and architectural drawing, eight to twelve. Practical arithmetic, two to five.

The summer term, which follows this, embraces the practical instruction.

SUMMER TERM.

Monday. First Class, first division — in the workshops from seven A. M. to twelve, and from one until seven P. M. Second division — machine drawing, eight to twelve. Applied mathematics, two to five.

Second Class. Machine drawing, eight to ten. Modeling, ten to twelve. Chemistry, two to four. Repetition, four to five.

Tuesday. First Class, first division — analytical dynamics, eight to ten. Drawing of machines from original designs, nine to twelve. Machinery, two to five. Second division — decorative and architectural drawing, eight to twelve. Chemistry, two to five.

Second Class. Decorative and architectural drawing, eight to twelve. Elementary mathematics, two to four. Repetition, four to five.

Wednesday. First Class, first division — in the workshops from seven to twelve, and from one to seven. Second division — machine drawing, eight to ten. Modeling, ten to twelve. Applied mathematics, two to five.

Second Class. Machine drawing, eight to twelve. Practical arithmetic, two to four. Materials used in the arts, four to five.

Thursday. First Class, first division — in the workshops from seven to twelve, and from one to seven. Second division — machine drawing, eight to ten. Modeling, ten to twelve. Applied mathematics, two to five.

Second Class. Decorative and architectural drawing, eight to ten. Modeling, ten to twelve. Chemistry, two to four. Repetition of the lesson, four to five.

Friday. First Class, first division — analytical dynamics, eight to nine. Drawing of a machine for an original design, nine to twelve. Machinery, two to five. Second division — chemistry, eight to nine. Applied mathematics, nine to twelve. Chemistry, two to five.

Second Class. Machine drawing, eight to twelve. Elementary mathematics, two to four. Repetition of the lesson, four to five.

Saturday. First Class, first division — in the workshops, from seven to twelve, and from one to seven. Second division — decorative and architectural drawing, eight to twelve. Applied mathematics, two to five.

Second Class. Decorative and architectural drawing, eight to twelve. Practical arithmetic, two to four. Materials used in the arts, four to five.

The chemical division of the practical classes is engaged every day in the laboratory. On Tuesday and Wednesday, the library is open for reading from five to eight, P. M.

The collections for carrying out the various branches of instruction are upon the same liberal scale with the other parts of the institution. There is a library of works on

architecture, mechanics, technology, the various arts, archaeology, etc., in German, French, and English. This library is open twice a week, from five to eight in the evening, to the pupils of the first class of the school, and to such mechanics as apply for the use of it.

There is a rich collection of drawings of new and useful machines, and of illustrations of the different courses, belonging to the institution. Among them is a splendid work, entitled Models for Manufacturers and Artisans, (Vorlegeblätter für Fabricanten und Handwerker) containing engravings by the best artists of Germany, and some even from France and England, applicable to the different arts and to architecture and engineering. Among the drawings are many from original designs by Shenckel, of Berlin. There is a second useful but more ordinary series of engravings, on similar subjects, also executed for the use of the school. These works are distributed to the provincial trade schools, and presented to such of the mechanics of Prussia as have especially distinguished themselves in their vocation. The collection of models of machinery belonging to the school probably ranks next in extent and value to that at the Conservatory of Arts of Paris. It contains models of such machines as are not readily comprehended by drawings. Most of them are working models, and many were made in the workshops of the school. They are constructed, as far as possible, to a uniform scale, and the parts of the models are of the same materials as in the actual machine. There is an extensive collection of casts, consisting of copies of statues, basso-relievos, utensils, bronzes, and vases of the museums of Naples, Rome, and Florence, and of the British Museum, and of the models of architectural monuments of Greece, Rome, Pompeii, etc., and copies of models, cameos, and similar objects; those specimens only have been selected which are not in the collection of the Academy of Fine Arts of

Berlin, to which the pupils of the Institute of Arts have access. There are good collections of physical and chemical apparatus, of minerals, of geological and technological specimens.

The instruction is afforded in part by the lectures of the professors, aided by text books specially intended for the school, and in part by the interrogations of the professors and of the assistants and repeaters. At the close of the first year there is an examination to determine which of the pupils shall be permitted to go forward, and at the close of the second year to determine which shall receive the certificate of the institute. Although the pupils who come from the provinces are admitted to the first class of the institute, upon their presenting a testimonial that they have gone through the course of the provincial schools satisfactorily, it frequently happens that they are obliged to retire to the second, especially from defective knowledge of chemistry.

The cost of this school to the government is about twelve thousand dollars annually, exclusive of the amount expended upon the practical courses and upon the collections — a very trifling sum, if the good which it is calculated to do throughout the country is considered.

Catalogue of Lectures Delivered in the Polytechnical School at Hanover.

PREPARATORY SCHOOL.

		Hours.
Low Mathematics,	Grelle, Guthe,	10
Theology and Botany, Mineralogy,	Mühlenpfardt, Guthe,	
Sketching,	Schulz, Blank, Küsler,	15
Outline,	Bruns,	4

PRINCIPAL SCHOOL.

High Mathematics,	Grelle,	7
Geometry,	Slegemann, Büsing,	5
Practical Geometry,	Hunäus, Busing,	10
Mechanics, I course,	Ritter,	8
" II course,	"	7
Construction of machinery,	Grove,	
" I course,	"	5
" II course,	"	5
Theory of machinery,	Rühlmann,	
" I course,	"	5
" II course,	"	5
Architecture, I course.		
Constructions and Material,	Debo, Güer,	6
Ornamental,	Lüer,	4
Theory of Form and Perspective,	Köhler,	7
To sketch buildings,	Hase, Köhler,	11
Delivery,	Debo, Güer,	6
Ornamental,	Güer,	3
History of Architecture,	Hase,	4
Roads, Rail-Road Constructions,	v. Kaven,	12
Water-works,	Trenting,	13
Con. of Bridges,	Trenting, V. Kaven,	34
Geognosy,	Hunäus,	3
Theoretical Physics,	v. Quintus Talius,	5
Practical Physics,	"	5
Theoretical Chemistry,	Heeren,	5
Technical Chemistry,	"	5

PRACTICAL CHEMISTRY.

Experimenting in the Laboratory,	Kraut,	22
Analytic Chemistry,	Kraut,	3
Mechanical Technology,	Karmarsch, Hoyer,	5
Embossing works,	Engelhardt,	5
Moulding works,	Bruns,	5

Catalogue of the Lectures to be Delivered in the Frederick William University at Berlin, from Oct. 15, 1868, till March 19, 1869.

THEOLOGY.

	Hours.
By Prof. Dr. Hengstenberg :	
The Introduction to the canonical books Old Testament,	5
The Prophecies of Isaiah,	5
The History of the Passion and Resurrection of Christ according to the four Gospels.	2
By Prof. Gic. Vatke :	
The Introduction to the Old Testament,	5
The Origin of the Pentateuch,	1
By Prof. Benary :	
Genesis,	5
The Book of the Judges,	1
By Gic. Kranichfeld :	
Genesis,	5
The Book of Daniel,	2
Homiletic Exercises, Exercises in the Arabian and Hebrew language,	
By Gic. Gerlach :	
The Psalms,	5
Difficult Parts of the Old Testament explained in the Latin Language,	2
By Prof. Dr. Rödiger :	Hours.
The Book of Job,	4
Solomon's Song	1
By Prof. Dr. Dieterici :	
The Lesser Prophets,	2
By Prof. Gic. Strauss :	
Biblical Archæology,	2
Homiletics,	1
Homiletic Exercises,	1
Catechetical Exercises,	1
By Prof. Dr. Dorner :	
The Gospel of John,	5
The Christian Symbolism,	5
By Prof. Dr. Frommann :	
The Epistle to the Romans,	5
The Homiletics,	3
By Prof. Dr. Twesten :	
The Epistles to the Thessalonians, Galatians, Philippians, Colossians, Ephesians,	5
The Principles of the Dogmatical Interpretations of the New Testament,	1
Christian Dogma,	6

By Prof. Gic. Messner: Hours.
Parts of the Revelations, ... 1
The Biblical Theology of the New Testament, ... 5

By Prof. Dr. Piper:
The 2d part of the Church History, .. 5
The Archæological and Patristic Exercises, ... 2

By Prof. Gic. Weingarten:
The 2d part of the Church History, .. 5
The History of the Reformation, ... 2

By Prof. Dr. Semisch:
The 3d part of the History of the Church, ... 6
The Christian History of Dogma, ... 6

By Gic. Preuss:
The Apology of Christianity, ... 5
A Disputation on the Augsburg Confession, ... 1

By Prof. Dr. Steinmeyer:
Practical Theology, ... 5
The Catechetics, ... 1
Homiletic Advices, ... 1

By Gic. Kleinert:
Theological Disputations, ... 1

JURISPRUDENCE.

By Prof. Hydemann:
Encyclopædia or Methodologia of Jurisprudence, ... 3
The Prussian Common Law, ... 5
Disputations on Prussian and French laws, ... 2
The Code Napoleon, ... 3

By Prof. Berner:
Law by Nature, ... 4
Laws of Nations (International Law), 3
German law of Punishment (penal justice), ... 4
Penalty Process, ... 2
Criminal Psychology, ... 1

By Prof. Michelet:
Law by Nature in connection with Universal History of Law, ... 4

By Prof. Rudorff:
Institutions and Antiquities of the Roman Law, ... 5
History of the Roman State Law, ... 1

By Dr. Schmidt:
Encyclopædia or Methodologia of Jurisprudence, ...
On the Pandects and International History of the Roman law, also Exegetic Exercises., ... 6

By Dr. Baron:
Institutions and Antiquities of the Roman Law, ... 4
History of the Roman State law, ... 4
Dogmatical and Exegetical Exercises on the Roman law, ... 1
The Prussian Common Law, ... 5

By Dr. Degenkoll:
Institutions and Antiquities of the Roman law, ... 5
Practical exercises, ... 1

By Dr. Eck:
Institutions of the Roman law, ... 4
History of the Roman State law, ... 4
Selected Civil law Cases, ... 1

By Dr. Ryck: Hours.
Institutions of the Roman law, ... 4
Law of inheritance, ... 2

By Prof. Bruns:
Practical law of pandects, ... 6
Law of Inheritance, ... 3
Selected Pandects, ... 1

By Prof. Gneist:
Law of Inheritance, ... 3
History of the English Constitution, 1
Common and Prussian Civil Law, ... 4

By Prof. Heffter:
Canon Law, ... 4
The Public Law of Prussia and other German States, ... 4

By Dr. Hubler:
Canon Law, ... 2
Canonical Civil Law, ... ?

By Prof. Homeyer:
History of the German Empire and Law, ... 2

By Prof. Kühns:
History of the German Empire and Law, ... 2
German Law concerning Bills of Exchange, ... 1
Exercises of the German law, especially of the Commercial Law, ... 1
German Statute Law, ... 4

By Dr. Lewis:
History of the German Empire and Law, ... 4
Definition of the Sachsenspiegel, ... 2

By Dr. Gierke:
History of the German Empire and Law, ... 2

By Dr. Behrend:
Definition of the Sachsenspiegel, ... 1
German Statute Law, ... 5
German Commercial Maritime and Exchange Law, ... 4
On Exchange and Banking Business, 1

By Prof. Beseler:
German Statute law including the Feudal, Commercial, Exchange and Maritime Law, ... 5
German Law, ... 1

By Prof. V. Holtzendorff:
State Law, regarding especially the Documents of the Prussian Constitution, ... 4
Politic and Common State Law, ... 2
Common German and Prussian Penal Justice, ... 4
Penalty Process, ... 2
On Death Penalty, ... 1

By Prof. Hinschius:
Prussian Family Law, ... 1

MEDICAL SCIENCE.

By Prof. Schulz Schubzenstein:
Encyclopædia and Methodologia of the Medical Science, ... 2
General Pathology and Therapeutics, 4
Remedy Theory; Essays of the Effect of Medicine on Animals, ... 6

By Prof. Hirsch:
General History of Medical Science, 3
General Pathology and Therapeutics, 5

By Prof. REICHERT: Hours.
Anatomy, ... 6
Anatomy of the Brain and Spinal Marrow, ... 1
The Theoretical Histology..... 1
A Microscopical Anatomical Course, ?
Dissections, ... 12

By Prof. HARTMANN:
The Osteology and Syndesmology of Man, ... 2
Anatomy of the Power of Senses,.... 1

By Prof. DU BOIS-REYMOND:
The 2d part of Physiology,..... 5
Physiological Exercises in the Physiological Laboratory, assisted by Prof. Rosenthal,..... ?

By Prof. ROSENTHAL:
The Experimental Part of Physiology, ... 2
Theory of Electricity,..... 1

By Dr. MUNK:
Selected Chapters of Physiology,.. 4
Physical and Physiological Base of the Electrotherapy, with experiments, ... 1

By Dr. HERMANN:
About the Physiological Effects of Gas, with experiments,..... 1
Medical Chemistry, with experiments,..... 2
Physiological and Pathological Chemical Tasks,..... ?
The Theory of Poison, ... 2

By Dr. SIEBREICH:
Chemistry of Digestion,..... 1
Practical Medical Chemical Course, with experiments,..... 3

By Prof. VIRCHOW:
General Pathology and Therapy, including General Pathological Anatomy, ... 4
A Demonstrative Course of Pathology, Anatomy and Microscopy with advice to Pathological Sections,..... 3
Practical Courses of the whole Medical Diagnosis,.....

By Dr. WESTPHAL:
Percussion and Auscultation, with practical exercises,..... ?
Laryngoscopic Course,..... ?

By Prof. LEWIN:
Syphilis,..... ?
The Clinical Medicine of Syphilitic and Cutaneous Diseases,..... 3
Laryngoscopy, with practical exercises,..... 1
Auscultation, Percussion and Laryngoscopy, with demonstrations,.... ?

By Dr. WALDENBURG:
Laryngoscopy, with practical exercises,..... 1
Practical Course on Auscultation, Percussion and Laryngoscopy,... 3

By Dr. EULENBURG:
Demonstrations of Diseases of the Nerves, with practical exercises; for three months,..... 4
Electrotherapy,.....

By Prof. GRIESINGER:
Clinical Medicine of the Diseases of Nerves and Mental Debilities,.... 5

By Prof. MITSCHERLICH: Hours.
The Theory of Remedy..... 6
On the Agitating Remedies,..... 2
General, and Special Surgery with demonstrations, ...

By Dr. HELFT:
On Medical Climatology..... 1
On the Use of Medical Springs for Chronic Diseases,..... 4

By Dr. VALENTINER:
On the Medical Use of Mineral Water for Chronic Diseases,..... 2

By Prof. YUNGKEN:
General and Special Surgery..... .. 4
On the Ruptures of the Human Body, 2

By Dr. FISCHER:
General and Special Surgery,..... 4
On Ruptures in the Abdomen and their Treatment,..... 2

By Prof. V. LANGENBECK:
Chirurgery, with surgical anatomical demonstrations,..... 3
Surgical-Clinical-Medicine in the Royal Surgical University Clinicum,..... 5

By Dr. RAVOTH:
On Chirurgery,..... ?

By Prof. GURLT:
Dissections,..... 6
The Theory of Osteoceles and Dislocations,..... 2

By Prof. V. GRAFE:
The Eye—its Diseases and Remedies,..... 9

By Prof. BOHM:
Eyeglasses and their Medical Effects, 1

By Dr. ERHARD:
Diseases of the Auditory Nerve in connection with demonstrations, 1

By Dr. LUCAE:
On the Eye and Ear, with demonstrations and experiments,..... 1

By Prof. ALBRECHT:
Diseases of the Teeth and Mouth,.. 2

By Prof. MARTIN:
Gynæcology and Midwifery,..... 5
Clinical and Policlinical Medicine in connection with Midwifery and Gynæcology,..... 6

By Prof. EBERT:
Policlinical and Clinical Medicines of Diseases of Children,..... 3

MEDICAL JURISPRUDENCE.

By Prof. LIMAN:
Dissections,..... ?

By Prof. SKRZECZKA:
Dissections,..... ?
Medical Jurisprudence,..... 6
Selected Chapters of the Medical police,..... 2

By Dr. SCHULTZ:
Medical Climatology,..... 2
On the Climate of Italy,..... 1

PHILOSOPHICAL SCIENCES.

By Prof. TRENDELENBURG:
General History of Philosophy,.... 5
Psychology..... 4
Explanation of Aristotle's 2d Book of Physics, in the Philosophical Exercises,..... 2

By Prof. ALTHAUS: Hours.
General History of Philosophy, up to the 18th century, ... 4
History of Philosophy from the beginning of the 18th century, ... 2
Encyclopædia of the Philosophical Sciences, including Logic, ... 4

By Prof. GRUPPE:
History of Greek Philosophy, ... 2

By Dr. MARKER:
Natural Philosophy of the Ancients, according to Aristotle's Physics, 4

By Prof. MICHELET:
Logic and Encyclopædia of the Philosophical Sciences 4
Philosophical Conservatory Disputation, ... 1.

By Prof. HARMS:
Logic and Metaphysics, ... 4
Practical Philosopny, or Ethics, ... 4
Philosophical Exercises, ... 1

By Dr. DUHRING:
Logic, combined with a course of Philosophy, according to the principles of Natural Dialectics, ... 4
Philosophical Privatissimis, ... 4

By Prof. WERDER:
Psychology and Anthropology, ... 3

By Prof. STEINTHAL:
Philosophy of Language and General Grammar 4

By Prof. MASSMANN:
Pedagogical Questions, ... 2

MATHEMATICAL SCIENCES.

By Prof. KUMMER:
Theory of Numbers, ... 4

By Dr. KRONECKER:
Theory of Algebraic Algebra, ... 2

By Prof. WEIERSTRASS:
Theory of the Elliptical Functions, 6

By Prof. FUCHS:
Theory of the Differential and Integral Calculus, ... 4

By Dr. HOPPE:
Integral Calculus, ... 4
Analytic Geometry, ... 4

By Prof. OHM:
Analytic Mechanics, ... 3

By Prof. FORSTER:
Selected chapters, Astronomical Mechanics, ... 4
The History of Astronomy, ... 2

By Dr. AUWERS:
The Double Stars, ... 2

THE PHYSICAL SCIENCES.

By Prof. POGGENDORF:
General History of Physics; from Galileo to the present time, ... 2

By Prof. MAGNUS:
Physics with Essays, ... 5
Practical Physical Exercises, ... ?
Physical Colloquia, ... ?

By Prof. DOVE:
Experimental Physics, ... 2
Meteorology, ... 2

By Prof. ERMAN: Hours.
Physics of the Earth; or the Theory of the Geographical and Cosmographical Phenomenon, ... 3
Theoretical and Practical Advices regarding Scientific and Physical Observations, ... ?

By Prof. GUINCKE:
Theory of Electricity, ... 4
Optics, ... 2

By Dr. PAALZOW:
Mechanical Theory of Warmness, ... 1

By Dr. OPPENHEIM:
The History of Chemistry of our Age, 2
Organic Chemistry, ... 3

By Dr. SONNENSCHEIN:
The History of Chemistry, ... 1
Judicial Chemistry, with Essays, ... 2
Practical Chemical Tasks, ... 6
Chemical Colloquia, ... ?

By Dr. REMELE:
History of Analytic Chemistry, ... 1
The Quantitative Parts of Analytic Chemistry, with experiments, ... 3
Chemical Mineralogy, ... 3

By Prof. HOFMANN:
Experimental Chemistry, ... 3
Introduction to Analytic Chemistry, 1
Chemical Experimental Exercises, .. 6

By Dr. WICHELHAUS:
Organic Chemistry, ... 4
Scientific Chemical Researches, ... 6

By Prof. SCHNEIDER:
Organic Chemistry, especially for Medicine and Pharmacy, ... 5
Organic Bases, ... 1
Inorganic Pharmacy, ... 3
Practical Chemical Exercises, ... 6
Summary of Zoology, ... 3
Natural History of Tape-worms of Man, ... 5
A Zoological Course directed by him

By Prof. BAEYER:
The 2d part of Organic Chemistry, with experiments, ... 4
Practical Exercises on Organic Chemistry, ... 6

By Prof. RAMMELSBERG:
The 1st part of Special Inorganic Chemistry, ... 4
The Chemical Principles of Metallurgy, ... 3

By Prof. ROSE:
Mineralogy, ... 6
Crystallography, ... 1

By Prof. BEYNCH:
Petrifications, ... 4
Geognosy with regard to Mountains formed in Horizontal Layers, ... 2

By Prof. ROTH:
Geology, ... 2
Volcanoes, ... 1

By Dr. LASPEYRES:
General Petrography, ... 4

By Prof. BRAUN:
General Botany, regarding especially Medical and Economical Plants, .. 5
Exercises to determine Cryptogamical Plants, ... ?
Botanical Conservatory, ... ?

By Prof. KARSTEN: Hours.
Medical Botany showing Medical Plants and Drugs, ... 6
Pharmacognosy, ... 4
Anatomical Physical Exercises, ... ?

By Dr. KNY:
Fructification of Plants, ... 2
Anatomical and Physical Exercises, 5

By Prof. PETERS:
General and Special Zoology, ... 6
Zoological Zootomic Exercises, ... 2

By Dr. GERSTACKER:
General and Special Entomology with Microscopical Demonstrations, ... 3

By Prof. DU BOIS REYMOND:
Physical Anthropology, ... 1

SCIENCES OF STATE FINANCE AND INDUSTRY.

By Prof. HANSSEN:
People's Political Economy, ... 4
Science of Finances, ... 4
Financial Exercises, ... 1

By Prof. FRIEDLAENDER:
National Economy, ... 4

By Dr. DÜHRING:
National Economy acording to Principles of Critical Foundation, ... 4
Parties in the State and Society, ... 1
Political Eonomy, ...
Prussian Finances, Police and Administration, ...

By Prof. HELWING:
Police Science or Theory of intrinsic Administration, also Theory of State Economy, Agricultural, Industrious and Commercial Police. } 4
Examinations and Disputations on the Science of Politics and Finances, ... ?

By Dr. SCHULZ:
Police, ... 2

By Prof. THAER:
Principles of Agricultural Credit and Insurance, ... 1
Agricultural Production of Animals, 4
Colloquia on Selected Parts of the Practical Management of Agriculture, ... 1

By Prof. KOCH:
Agricultural Botany, with demonstrations on living plants, ... 2

By Dr. GERSTACKER:
Insects Pernicious and Useful to Agriculture, ... 2

HISTORY AND GEOGRAPHY.

By Prof. V. RAUMER:
History of Constitutions and Politics, 1

By Prof. KOPKE:
History of the Middle Ages, ... 4
Historical Exercises, ... 1

By Dr. ERDMANNSDORFFER:
History from the end of the Middle Ages with regard to Literature and Civilization, ... 4
History of the English Revolution, 2

By Prof. V. RANKE: Hours.
History of the Present Age, since the Declaration of Independence of the United States of America, 4
Historical Exercises, ... ?

By Prof. DROYSEN:
History since 1815, ... 5
Greek History, ... 4
Exercises of the Historical Society, ?

By Dr. HASSEL:
History of Prussia from 1784–1815, 1

By Prof. TAFFE:
Historical Exercises, ... 1

By Prof. KIEPERT:
History of the Earth and Geographical Discoveries, ... 3

By Dr. BASTIAN:
History of Colonies from the 15th Century till the present time, ... 1
Ethnology and Anthropology, ... 4

By Prof. MÜLLER:
Geography and Knowledge of Different States of the New World, 4
The History of the New World, ... 1

THEORY AND HISTORY OF ART.

By Prof. HOTHO:
Æsthetics, with a Summary on History of Art, ... 2

By Prof. WERDER:
On Dramatic Art, ... 1

By Dr. MAERCKER:
Rhetoric, ... 1
Rhetorical Exercises, ... 1

By Prof. CURTIS:
History of Plastic Arts of the Greeks, and Romans, ... 5
Exercises of Classical Archæology and Monuments, ... ?

By Prof. FRIEDERICHS:
History of Greek-Roman Art, ...
Archæological Exercises, ... 1

By Prof. LEPSIUS:
Egyptian Monuments, ... 1

By Prof. BELLERMANN:
History of Music of the middle ages, from beginning of Christianity till Franco of Cologne, 13th century, .. 2
Counterpoint Exercises, ... 2

PHILOLOGICAL SCIENCES AND EXPLANATION OF AUTHORS.

By Prof. STEINTHAL:
The style of the Indo-Germanic Language, with regard to the Greek, Latin and German Language, ... 4
History of the Science of the Languages of the Greeks and Romans, 1

By Prof. MASSMANN:
Science of Handwriting, ... ?
Explains the Germania of Tacitus, .. 4
Monuments regarding the Gothic Languages, combined with the History of the Gothic Language, 4

By Prof. KIRCHHOFF:
History of Greek Literature till time of Alexander the Great, ... 4
Explains Medea of Euripides, ... 4

By Prof. HAUPT:
Explains the Birds of Aristophanes, 4
Explains the Eunuchus of Terentius, 4

By Prof. MULLACH: Hours.
Explains Thucydides in the Latin Language,..... 1
Explains Cicero De Oratione,..... 4

By Prof. HUBNER;
The Funeral Oration of Pericles over Thucydides,..... 1
History of Roman Literature,..... 4
On Roman Private Antiquities, with the Help of Monuments of Art,... 3

By Prof. BEKKER:
Oration of Isocrates,..... 2

By Dr. BONITZ:
On the Life and Literary Works of Plato, with the explanation of the Dialogue, Theaetel,..... 2

By Prof. GEPPERT:
Roman Antiquities,..... 4
The Casina of Plautus,..... 2

By Prof. TAFFE:
Latin Paleography,..... 3

By Dr. MAERKER:
Lucrez's books, Treating the Things of Nature,..... 1

By Prof. MEMMSEN:
Selected Parts of Gaius's Institutions,..... 1

By Prof. MULLENHOFF:
The Nibelunge Noth, ... 4
The Songs of the Old Edda,..... 4
The German Exercises to be continued,..... 1

By Prof. TOBLER:
French Grammar, ... 4
On the Novelas Ejemplares of Cervantes,..... 2
Exercises of his Romanian Society, 1

By Lec. FABBRUCCI:
History of Italian Literature in the Italian Language,..... 3
Italian Language,..... 2
Offers an Italian and French course, Privatissimis .....

By Lec. SOLLY:
History of English Literature from 15th century, in the English Language,..... 1
Offers a Privatissimis in the English Language.....

By Prof. WEBER:
Sanskrit Grammar,..... 3
Explains Bhavabhûtis Mâlatimâdhava,..... 2
Hymns of Rigveda or Atharvaveda, 3
Zend, or Pali Grammar, ... 2
Offers Privatissimis in Sanskrit, Pâli or Zend..... .....

By Dr. TOHAENTGEN; Hours.
The Grammatical Sûtra of Pânini,.. 2

By Dr. HAARBRUCKER;
The Syrian Language,..... 2
The Arabian Language,..... 3

By Prof. RODIGER:
Solomon's Song,..... 1
The Book of Job,..... 4
The Koran and other Arabian tenets, also the Arabian Syntax,..... 3
Offers Privatissimis for the Hebrew, Arabian or Ethiopian language...

By Prof. DIETERICI:
Grammar of the Arabian language, 3
Explains some Arabian Authors,.... 1

By Lic. Dr. KRANICHFELD:
Grammar of the Arabian language, with practical exercises,..... 2

By Dr. WETZSTEIN:
On the Idiom of the Zeltaraber,.... 1
On the Lyric Poetry of the Arabians, 2

By Prof. BENARY:
The Hebrew language and the other similar Dialects, Privatissimis....

By Prof. LEPSIUS:
Egyptian Grammar,..... 3

By Dr. PIETRASZEWSKI:
The Persian Grammar, and Zend Language, also the Polish and Russian Language,..... 2
The Turkish Grammar with Translation of Kirk Wezir,..... 2
Offers Privatissimis in the Persian and Turkish Language.....

By Prof. SCHOTT:
On the Literature of People of Finland Descent,..... 2
The Finland (Suomi) Language,.... 2
The Chinese Language,..... 2

By Lec. MICHAELIS:
German Stenography, with Practical Exercises,..... 2
Practical Stenographical Exercises, 1
Offers Privatissimis in the German, English and French Stenography..
On the Principles of the German Orthography,..... 1

GYMNASTICS.

Mr. NEUMANN teaches Fencing.
Mr. FREISING " Dancing.
Mr. HILDEBRANDT " Riding horseback.

PUBLIC INSTITUTIONS.

To the Royal Library, and University Library, every student is admitted. The Observatory, the Botanic Garden, Anatomical Zoolomical and Zoological Museum, the Herbarium, the Mineral Department, the Collection of Surgical Instruments and Bandages, the Physical Apparatus, the Pharmacological Collection, the Collection of Charts of the Royal Chartographic Institution, the Christian Archæological Collection of the University, the Museum of Arts, the Collection of Plaster Casts, the Archæological Collection of the University, can be used during the course.

The Exegetical Exercises of the Theological Seminary, regarding the New Testament, will be directed by Prof. Dr. TWESTON; those of the Old Testament by Prof. Dr. HENGSTENBERG; those of the History of the Church and Dogmas by Prof. Dr. SEMISH. The following Institutions are for the study of Medicine and Surgery:

The Anatomical Theatre and Physiological Laboratory, the Medical, Surgical Polyclinical Institution, the Clinicum for Surgery and Medical Science for Eyes, the Clinicum of the University, for Midwifery, the Polyclinic for Midwifery, the Clinical Department of the Charitè Hospital, as the Operation Clinicum for Surgery, the Clinicum for Medical Science for Eyes, and Perfection of Oculists, the Clinicum for Syphilitic Patients, Psychiatric Clinicum and the Clinicum for the Disease of the Nerves, the Clinicum for Midwifery and Treatment of Women lying-in, and New-born Children, the Pathological Institution in the Charitè, and the Department for Practical Exercises of Judicial Medicine, in the Anatomical building.

In the Philosophical Seminary under the direction of Prof. HAUPT, the Dialogue of Tacitus will be explained every Wednesday.

The Orations of Lysias will be explained under the direction of Prof. KIRCHHOFF, every Saturday.

The Disputation Exercises will be directed also by Prof. KIRCHHOFF.

The Exercises of the Mathematical Seminary will be directed by Prof. KUMMER and Prof. WEIERSTRASS.

Art. II. *The Flora of the Adirondacks.* By Geo. T. Stevens, M.D.

[Read before the Albany Institute, February, 1868.]

In the midst of the great state of New York lies the Switzerland of America; a region where huge mountains elevate their summits against the deep blue sky, and thick forests spread over tens of thousands of acres. Here, between the vast rugged hills whose sides are, even in winter, perpetually green, lie sleeping almost innumerable lakes, reflecting the green of the hills, like gems in their caskets of unhewn granite.

Deep gorges and beautiful valleys divide the towering hills, and hundreds of creeks and rivulets wind in crooked channels their ways to the lakes, now gliding silently between the overhanging trees and shrubs, whose deep shade shuts out the sunlight, now tumbling noisily over stony bottoms and anon plunging over the side of some rocky declivity in foaming cataract or laughing cascade, sometimes dissolving into light spray before reaching the far down bottom, and then collecting in crystal streams overhung by long grasses and kissed by bright flowers.

Here, among the wildnesses of forests and mountains, stalk the red deer and the moose, ranging their pathways from the mountain tops to the lake sides, or cropping the green herbage from glen or marsh. The speckled trout in great numbers disport in the shining waters of the lakes or timidly shrink under the overhanging banks of the streams. The thrumming of the partridge is heard along the hill sides, and the raven and the eagle are seen wheeling in elegant circles above the mountain cliffs. Here, too, the tourist is startled by the piercing screams of the

catamount and the harsh cry of the lynx. Beds of iron, enough to supply a world, are hidden among these rude crags, and untold wealth of pines far in the interior of this region, await the opening of railway transportation to supply our lumber markets. If, with great toil, we climb to the summit of some commanding peak, struggling upward through gaping chasms and cragged defiles, avoiding precipitous cliffs, pulling ourselves up rocky steeps by rootlets and branches until we reach the eminence, we shall see that this mountainous region is not all an untamed wilderness. Looking from the summit of Mt. Marcy or Whiteface, on one side we shall gaze upon a sea of mountains rising in huge billows like great waves upon the storm-swept ocean; a hundred lakes, lying in their rugged bosoms, glisten in the sunlight before our eyes, and the utmost rudeness pervades the scenery; but turning about and looking in an opposite direction, the eye falls upon a landscape beautiful and varied beyond description. Before us, far to the northward and southward and eastward, fertile valleys and verdant fields alternate with groves and forests, and the little hamlets of the interior dotting the landscape here and there among the hills, contrast beautifully with the thriving villages along the borders of Lake Champlain. Away, as far as the eye can reach to the northward, may be seen the waters of the St. Lawrence, a silver ribbon stretched just below the horizon. Confronting us from the east, beyond Lake Champlain is the noble range of Green mountains, no longer green at this distance, but misty blue, their rounded and regular summits contrasting strongly with the sharp and rugged peaks of the surrounding Adirondacks. The beautiful Champlain lies between the slopes of these two ranges of mountains, an object of surpassing loveliness, its green islands resting emerald-like upon its surface.

Throughout this wildly picturesque region, varied in soil, in altitude, and even in climate, the flora is as diversified as the country. In no section of our state can the botanist find a field so rich in choice and beautiful species, yet few regions in the country have been less thoroughly explored by botanists than this.

If, now, we traverse this region for its plants, commencing at the borders of the Champlain, and making our way toward the heart of the wilderness, we shall find our territory divided into several floral sections or zones, depending on geological formation, the degree of culture to which the country is subjected, and the altitude. These conditions are not, however, entirely independent of each other.

In our present paper our observations will be confined chiefly to the county of Essex for several reasons. This county embraces a great portion of what is called the wilderness; it is well known as the most broken and mountainous county in our state. Here are found the highest mountain peaks and the deepest gorges; and here also is found, perhaps, the finest natural scenery in North America. The wonderful diversity of its forest scenery renders this county particularly attractive to the botanist. Its limits include about twelve hundred square miles, extending along Lake Champlain forty-three miles, and westward into the wilderness forty-one miles. All the mountain ranges north of the Mohawk cross this county in a series of almost parallel ridges extending nearly north and south. Here arise the Hudson, the Ausable and the Saranac rivers, and within the limit of this county are more than one hundred lakes, some of them among the most beautiful sheets of water in the world, imparting great variety to the scenery, while they so modify and reduce the temperature as to produce decided effects upon the vegetation.

We shall find little difficulty in drawing our geological chart. If a map of this whole Adirondack region were colored to correspond with its geological character, we should find an almost unbroken gray surface, representing the primary rocks. Only a narrow strip along the borders of Lake Champlain breaks the monotony of the gray. A blue line, extending from near Ticonderoga to Willsborough, tells of the calciferous and Chazy limestone; a little belt by the lake side, more then thirty miles long and averaging a mile wide; then the belt changes to red, indicating the Potsdam sandstone, which creeps behind the limestone a little to the southward, and from Willsborough northward forms the whole of the belt to the north boundary of the county. It is in this sandstone, at Keeseville, that nature has played the curious freak of riving the rocks asunder for a great distance, forming a wonderful gorge with high precipitous walls on either side through which flows the Ausable river.

We shall find the profile chart of our territory far more complicated. Yet we may, perhaps, draw a rude outline which will impart some idea of its characteristic features. The slopes rising from the lake are not, like those of the Vermont side, gentle, rising in monotonous undulations toward the great mountain range. These are bold and broken by sharp spurs and crags. In places, as at Port Henry, the mountain thrusts its precipitous sides fairly into the lake. Yet along these slopes are found grassy plains, pleasant valleys traversed by streams of clear water, and gently undulating hills. Thriving and beautiful villages are situated at short intervals by the lake where the smoke of the furnace stack and the steam from the factory tell of the industry of the people.

The land rises rapidly, and range after range of hills mount higher and higher, until we reach the principal cluster in the extreme western part of Essex county.

Along the lake's side, and for a mile westward we find but few rare or specially interesting plants. The flora here is generally that which belongs to the state at large; yet we have a few species not found elsewhere in the state, and some, which although by no means rare in other localities, are not found further in the interior of our region. Among the latter class is the *Juniperus Virginiana*, or red cedar, which I have found only along the lake's side. Near Port Henry is a little cluster and among the rocky pastures at Whallons bay it grows in some profusion. In this last named locality is found also the *Hedyotis Cærulea*, bluets, a delicate little herb with blue salverform flowers; and in the crevices and on the dry mould covering the slaty rocks, the *Arenaria Squarrosa* shows its thick clusters of white star like-blossoms. On the sandy plain about Keeseville may be found the *Spiranthes Gracilis*, by no means a common plant elsewhere in this county, its delicate stalk of white fringy flowers gracefully curling upon itself. The hickory is found along the borders of the lake wherever the lime rock prevails, but is rarely, if ever, seen in the interior.

The button bush, with its clusters of little white balls, and several species of *Cornus*, frequent the sides of pools and eddies. The *Quercus Mocrocarpa* (overcup white oak), and *Quercus Montana* (rock chestnut oak), are found on the islands and shores of the lake, and on the sandy beaches grows the diminutive sand cherry (*Cerasus Pumila*), rare in other sections of the state. Many forms of rush and carex are found along the shallow borders, some of them rare species.

Leaving the lake side and taking a higher range, including a belt of territory averaging from fifteen to twenty miles wide, extending from the north to the south boundary of our district, we shall find ourselves in a floral region scarcely equaled for the great diversity as well as

beauty of its species. Here we have the flora of hill and valley, of sandy plain and rich meadow land, of sphagnous marsh and clear running stream. The forest trees include all, or nearly all that are found elsewhere in the northern states. The maples, the beech, the birches and the oaks, butternut, hard hack and cherry, the tall white pine and the Norway pine, the single and the double spruce, the hemlock, balsam and arbor vitæ, the linden and poplar, the larch and the willow, the elm and the ash meet us wherever we turn, giving great variety of form and shade of green in summer, and contributing to the gorgeous colors of autumn for which these forests are so celebrated.

A few rarer species of forest trees are here. On the sandy plain two miles west of Keeseville I have often seen the *Pinus Inops*, Jersey pine, which has never been reported by any other observer in the limits of New York. There is also a group of these rare pines in a little grove half a mile west of Mrs. Wadhams's house in Westport. The canoe, or paper birch, rare in other sections of New York, is here found in abundance on the hill sides, and the *Abies nigra* or double spruce, although found in other parts of the state, abounds nowhere else, and it is among these hills that it attains its greatest dimensions. Of shrubs and herbs we have an almost endless variety. We may only mention some of the rarer and more beautiful forms, as our limits permit no attempt at making a catalogue. One of the most striking beauties of the Adirondack forests is the elegant climber *Clematis Verticilaris*, virgin bower. This superb plant, supporting itself upon small trees and underbrush, often reaches a height of twenty or twenty-five feet, and when in bloom covers the trees upon which it twines with rich purple campanulate blossoms, each nearly two inches in diameter, hanging in elegant festoons and appearing amidst the green foliage like swarms of butterflies. Another twining clematis, the *C. Virginiana*, is more common, often covering the hedges

and adorning the rough stone fences with an exuberance of dark green leaves and clusters of white flowers which are succeeded by large panicles of fruit with long white silky plumous tails. Where the meadows are clothed with their emerald mantle, we find the *Anemone Cylindrica* and *Pennsylvanica.* While under the shadow of the forest trees the little *Anemone Nemorosa* is swayed to and fro by the wind.

A dozen species of buttercups (*Ranunculus*), among them the *Ranunculus Reptans* and *R. Aquatilis*, two rare species, adorn our region. The first creeping among the mosses in shady woods, and on the shores of lakes, the other floating gracefully in the shallow waters of streams and ponds. Of violas the welcome harbingers of spring, we have eleven species. The various hued hepatica pushes its star like blossoms through the dead leaves in early spring, and the *Aquilegia* appears among the rocks, delighting the eye with brilliant colors. At Ticonderoga I found a variety of *Aquilegia Canadensis* with pure white flowers, a variety which I have never seen described. The weak-stemmed Claytonia, with its exquisitely painted pink bells, peeps out of the grass from groves and meadows, and the *Geranium Maculatum*, *Geranium Caroliniaum* and *Geranium Robertianum* adorn the shady woods and rocky ravines. The Fringed Polygala forms a purple carpet for many a grove, and three other species of the genus are found on the hill sides. Of Leguminous plants we have many beautiful species, but the order is not so rich as we find it farther south.

The order *Rosaceæ* furnishes many more choice and beautiful species. Four species of the rose proper find a home in the pastures and meadows, and the genus Spirea furnishes several of the most ornamental shrubs. The *Viburnum Pauciflorum* (mountain bush cranberry), rare elsewhere, is here not uncommon in mountain mea-

dows. The *Rhododendron Hispidum* is found in abundance in the high lands, a rare and most beautiful shrub. Near the village of Lewis, opposite the old yellow tavern, I found in 1858, and often since that time the *Iris Ochroleuca*, Yellow Iris, the largest and finest species of Iris native in this country, a magnificent aquatic plant, now for the first time reported as a native of New York.

The *Scirpus Sylvaticus* I found in Crown Point a number of years since, and I believe that it has never been found in the state by another botanist until my friend, Mr Peck of this city, found it in the same region last summer.

It were vain to attempt in this connection any catalogue of the plants of this section, but before passing to the highest mountain regions, let us collect some of the flowering plants from a single locality; a circle less than an eighth of a mile in diameter, one half of which is occupied by a pond of water, the other half by a swamp of sphagnum.

Among the mountains in the western part of Crown Point lies a little pond not more than forty rods long, in no place more than two or three feet deep. Primal forests surround this little sheet of water, but between the forests and it, lies a belt of sphagnum. If we push through a little pathway, or trail among the alders, we shall find in this little open space, objects of interest enough to engage the attention of the botanist for many hours. Rich as is this little spot in the rare and beautiful forms of its flora, it is but the representative of many a quiet place hidden among these mountain dales, which nature delights to adorn with some of her most exquisite and unusual productions.

First, as we approach the opening, and the alders begin to be replaced by the larch, we discover a shrub two feet high, with evergreen leaves, dark and shiny above, and with long rust-colored fur beneath; it is the *Ledum*

Palustre, Labrador Tea, and is one of the order Ericaceæ. If the peculiarity of its leaves, with their under garments of dark brown wool attract our attention, much more shall we be pleased with its large clusters of white flowers.

We shall find several other plants of the order *Ericaceæ* here, and we have not long to look, for close by the side of the Ledum grows a tall species of *Andromeda*, *A. Calyculata*, with a profusion of pink bell-shaped flowers, and a few steps further on, a smaller species, *A. Polifolia*, with nodding white blossoms; and as we come full into the opening, another little Andromeda with flowers larger than either and more beautiful, the *Andromeda Mariana*. A superb shrub scarcely more than a foot high, seems to set the whole mossy surface of the swamp in a bright red blaze. It is the *Kalmia Glauca*, dwarf laurel, with corymbs of brilliant red cup-shaped flowers. Another shrub nearly two feet high lines the borders of the pond and occupies many of the little mounds in the space. Its leaves at once betray its relation to the other, and when its buds expand to flowers a little later, we shall find them as bright and as showy as the first. It is the *Kalmia Angustifolia*. We now spy creeping along the mossy carpet, a delicate vine, almost concealing the moss in many places. It is the *Oxyocus Palustris*, cranberry, a graceful and delicate plant with light pink corollas and bright crimson berries. We have scarcely entered upon this garden of choice plants when our eye falls upon a group of singularly interesting plants. In a depression where the water rises to the surface of the sphagnum is found the *Menyanthes Trifoliata*, each plant consisting of a single trifoliate leaf and a spike bearing a pyramidal raceme of flesh colored flowers remarkably distinguished by the delicately fringed petals with soft hairs filling the floral tube.

Scattered in all parts of the sphagnum the *Sarracenia Purpurea*, huntsman's cup, sends up its remarkable hollow pitcher-form leaves whose cavities are almost always nearly filled with water. The verticiles of purple and green pitchers from the centre of which springs the tall, straight, stiff scape, crowned by a single nodding purple and yellow flower, two inches in diameter and as curious in structure as the leaves themselves, make up one of the most singular plants of this state. The variety with yellow flowers observed, I believe, nowhere else in our state, except in Seneca county, is found here. The *Calla Palustris*, the nearest American relative of the stately Egyptian Lily finds a place in the sphagnum; its broad green leaves and pure white flowers contrasting with the slender grasses with wooly heads growing close by. Floating on the surface of the pond is the *Nymphea Odorata* or white pond lily, one of the most ornamental plants of the United States, and the yellow pond lily whose strong smell is in unpleasant contrast with the delightful odor of its neighbor. Here, too, by the water's edge is the pickerel weed with its spikes of blue flowers. The round-leafed sundew, a curious little plant, with leaves beset with glandular hairs and tipped with a drop of clamny fluid which glistens like dew in the sunlight, would escape our notice did we not search carefully for it. The *Utricularia Cornuta* sends up its naked slender scape, crowned with two or three handsome yellow flowers, and its minute companion the *Utricularia Subulata*, creeps about among the mosses.

The class of plants which would most fix our attention in this little repository of northern flora but of which we have thus far failed to speak, belong to the Orchis tribe, a class of plants eminently calculated by their beauty to delight the eye and by the curious and unusual forms of their flowers, to attract especial attention from the botanist. No less than thirteen species of these curious

and interesting plants are to found in this little belt of sphagnum. Among the most beautiful are the *Arethusa Bulbosa*, an interesting and highly ornamental plant, consisting of a simple leafless scape, surmounted by a bright purple fragrant flower, the throat richly bearded within.

The *Pogonia Ophioglossoides* resembles the arethusa in appearance, but the flower is of a paler purple and the scape is furnished with a single bract-like leaf. The *Calopogon Pulchellus* with its half dozen fragrant and elegant purple flowers crowning its grass-like stalk, if not as delicate as the arethusa is far more brilliant and conspicuous. The white and purple fringed orchis are conspicuous for beauty, and the large white and yellow ladies' slippers grow where the mould of the woods meets the sphagnum. These are but a part of the rarest and fairest species found within this little space, of less than two acres. There are many grasses and sedges, mosses and aquatic plants which we need not stop to mention.

Leaving this little pond and its rare collection of plants we may strike directly for the Alpine region, which we can only reach by many hours of toilsome travel over roads rough with rocks and logs, and through hamlets, whose inhabitants gain a scanty livelihood by the rude culture of a few acres of stony land or by the more primitive means of the chase. As we approach the great mountains we are almost overpowered by the majesty of the scenery. Let it not be supposed by those who have not visited this region that there are no mountains but in Switzerland, or that we are to look for sublimity in American mountain scenery only among the Rocky mountains. Here, too, we have a grandeur of mountain scenery which can be felt but must be witnessed to be appreciated. Mount Marcy and McIntyre, Nipple top, and McMartin, Dix peak and Whiteface, each a mile high, are some of the points which tower above the sur-

rounding peaks and cover their tops with the clouds. As we approach nearer we find our way more and more obstructed by inaccessible cliffs and thickly matted firs and brush. Swamps impenetrable and streams impassable compel us to find our way by most circuitous routes. I cannot forbear to quote a few lines from the language of Professor Emmons, in describing this scenery from some lake: "It must be witnessed;" he says, "the solitary summits in the distance, the cedars and firs which clothe the rocks and the shore must be seen, the solitude must be felt, or if it is broken by the scream of the panther, the shrill cry of the northern diver, or the shout of the hunter, the echo from the thousand hills must be heard before all the truth of the scene can be realized."

It may readily be concluded that in these wild solitudes and on these immense elevations we shall find a new and characteristic flora. Our conclusion is well founded. In examining the flora about us we might suppose that we had been suddenly transported to some boreal region, for here we have many of the characteristic plants of Labrador and other frozen climes. Hence we have a rich and peculiar field of research. In passing from the lakes to the mountain summits, each of the great mountains will afford many of the peculiar species, but as in the hour allowed us we cannot climb them all, there are reasons why our principal examination should be confined to the sides and summit of Whiteface. This mountain is more accessible than the others. From its comparatively isolated position, although not so high as Marcy, it overlooks the mountain region with its multitude of lakes in Essex and Hamilton counties, affording a view unequaled from any of the other elevations. The top of the mountain is comparatively flat, and a long ridge runs off to the north, affording a much greater extent of surface on the summit than any of the others, and thus surpasses them all as a

field for botanical research. Climbing from the border of Lake Placid on the west side, or ascending by the more easy path cut by John Hickock on the east, even the unscientific observer will be struck with two important characteristics; first, the gradual change in the classes of vegetation; and second, the apparent change of seasons. We are passing rapidly from the flora of the temperate zone to that of the frigid, and from the full development of summer, or the ripe perfection of autumn to the buds and blossoms of spring time. The change is first observed in the trees. As we wait at the foot of the mountain or commence the ascent, we see about us familiar trees; the beech and maple, birch and bass, spruce and hemlock, with many stumps showing where the woodman has reaped his harvest of pine; but ascending, the deciduous trees gradually give place to the evergreens. The broad-leafed maples and birches are replaced by arbor vitæ and spruces. At length the broad leaves are all gone, and only the evergreens surround us. The trees are closer and smaller. It is an almost impenetrable forest, even where our path leads us upward; but now, balsams are thinly interspersed among the spruces, and soon there are as many of the former as of the latter. Still higher, the spruces and cedars are scattering, but the balsams cover the precipitous sides with matted green. At length the spruces are all gone, only the balsams remain. They grow smaller and smaller. The straight and symmetrical tree becomes a stunted, crooked stalk with straggling branches. In the battle for its life the elements have the advantage. The tree is dwarfed and dwindles to an unsightly shrub, then to a weak and almost prostrate vine, and then disappears; but we have not reached the top. One little tree is braver than its comrades, and challenges the bleak winds, even on the summit. It is the mountain ash. No longer a beautiful

tree to which birds flock to gather its red fruit, but a little stem six inches high never daring to put forth a blossom and always barren of fruit. Of lesser plants, a few meet us at every step of our progress. The little *Oxalis Acetocella* and the *Clintonia Borealis* have met our eye from the foot of the mountain to its very summit.

We have found along the path the *Solidago Thyrsoides*, which has never been reported as a native of this state, but which I found in abundance here in 1859 and at other times since. The *Solidago Virga Aurea* also finds its only home here.

My friend, Mr. Peck, in his tour among the mountains last summer, gathered a rich harvest of rare and new plants from the sides of Whiteface and its vicinity. Among them were the *Carex Scirpoidea* and *Carex Aperta*, not before reported; *Carex Houghtonii* from the shores of Lake Placid and *Alopecurus Aristulatus*, a species of great rarity, a little way from the lake. Fine specimens of the rare and to this state, but recently known *Potamogeton Prælongus* he found in the lake, and several species of rush and carex not before reported.[1]

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[1] The following are some of the rare mosses of the Adirondacks which have been found by Mr. C. H. Peck, who has recently visited this region under the direction of the Regents of the University. Except as here specified they are not found elsewhere in this state, and but few of them elsewhere within the limits of the United States:

Sphagnum Pylæsii, Mt. Marcy, Lake Avalanche.
Sphagnum Sedoides, same localities, also Mt. McIntyre.
Sphagnum Lindenbergii, slide of Whiteface, also in British America.
Andræa Crassinervia, Whiteface.
Dicranum Polycarpum, Marcy.
Dicranum Blytii, Adirondack Pass.
Dicranum Elongatum, Marcy and McIntyre.
Orthotrichum Obtusifolium, North Elba.
Grimmia Ovata, Mt. Marcy, Lake Avalanche.
Blindia Acuta, Keen, Edmonds Point; also on Catskill and White Mountains.
Pogonatum Arnigerum, Adirondacks.

The summit of Whiteface though bare of trees is by no means destitute of vegetation. A species of whortleberry *Vaccinium Cæspitosum*, not found elsewhere in the state grows among the crevices in great abundance. Here we find the rare *Streptopus Roseus* with its clasping taper-pointed leaves and pendulous, bell shaped, rose-purple flowers, and the *Luzula Parviflora*. The *Diapensia Lapponica* which, save on the White mountains, has no home elsewhere than on these peaks this side of Labrador and the northern regions of Europe; the *Empetrum Nigrum*, black crowberry, a native of the coldest regions of British America, is here; the *Nabalus Bootii* with its haliber-shaped leaves and the *Nabalus Nanus* are both peculiar to these Alpine summits, the highest peaks of the White mountains of Mount Marcy and Whiteface, being the only home of either as far south as the United States.

But these towering peaks are also crowned with beauty. There can be none with senses so obtuse as not to be delighted with the minute and delicate little *Arenaria Grœnlandica* whose little white stars fill up the crevices of the rocks, fearless in its spotless innocence of the cold storms that sweep about it all seasons, and the beautiful white-flowered *Potentilla Tridentata* forms an elegant carpet over many an unsightly rock. The *Arbutus Alpine*, found only by myself in this state, creeps among the wortle bushes, upon the very summit.

We have passed hastily from the Champlain valley through the hilly country, and to the mountain tops,

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Aulacomnion Turgidum, Mt. Marcy.

Bryum Pallens, Whiteface. Found also by Mr. James, about the same time on White Mountains.

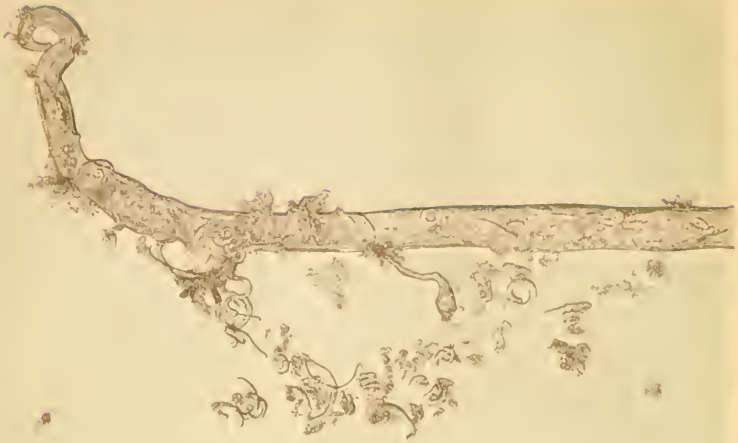
Conostomum Boreale, Marcy, McIntyre.

Tetraphlodon Mnioides, Whiteface, also on Catskills.

Pylaisœa Polyantha, Adirondacks and Catskills not found elsewhere on this continent except in British America.

Hypnum Montanum, *H. Dimorphum*, and *H. Sarmentosum*, Adirondacks and White Mountains.

stopping for a moment at the different stages of our journey, not to find all the floral treasures of the region, but to notice a few of the more interesting specimens. We have made no attempt to describe at any length the botany of the region. Our object has been by calling attention to a few of the evidences of the floral wealth of our territory, to awaken an interest in it, and to add the influence of this hasty sketch to the promotion of further and more systematic research, in this almost unexplored section of our state.



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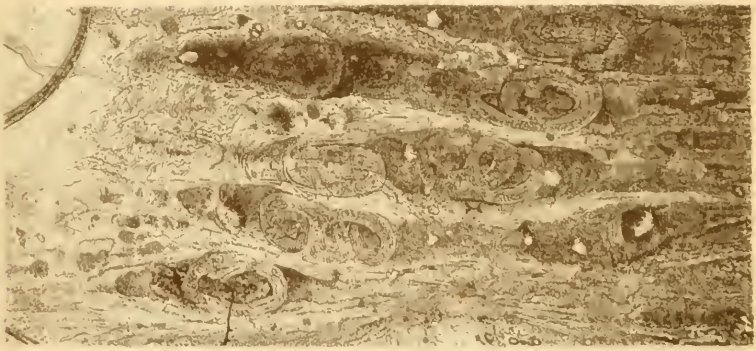

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Art. III. *The Trichina Spiralis.* By Edward R. Hun, M. D.

[Read before the Albany Institute, January 5, 1869.]

The Trichina Spiralis is a round worm belonging to the class of Nematoidea, and is found as a parasite affecting man and certain animals.

It was first found in human muscles by Mr. Hilton in 1832, and three years later was described by Professor Owen, who gave to it the name of Trichina Spiralis, from its slender form and habit of coiling itself up in a spiral shape. From this time, until 1860, the Trichina was frequently observed in the muscles of subjects in the dissecting room, but no account was given, and no theory formed as to how it got there. In all these cases the worm was found enclosed in a calcareous cyst.

Zenker of Dresden, in 1860, first called public attention to the fact that these little parasites, hitherto considered harmless, might be, and often were, the cause of severe and fatal diseases. A farmer, his wife and several other persons were attacked with a severe illness after eating of the flesh of a pig raised and slaughtered on their farm near Dresden — a servant who had eaten some of the meat died. Zenker, upon examination, found Trichinæ in the ham, head cheese and sausages made from the pork, and the muscles of the dead girl were filled with them. He sent some of the muscle to Professor Virchow of Berlin, who, by a series of experiments upon animals, developed the following interesting facts:

The Trichina, as found free in the muscles, is a round worm about one-twenty-fifth of an inch in length, rather more pointed at its cephalic then at its caudal extremity.

A digestive canal runs the whole length of the animal, and at its posterior part is a closed sac running about one-third of its whole length and filled with granular matter.

No sexual organs are to be seen.

If portions of this muscle are introduced into the stomach of certain animals (as rabbits for example), and these animals are killed and examined at different intervals, we find that the Trichina passes through the following stages of development.

During the three days following its ingestion it grows rapidly in size, becoming from three to four times its original length. At the same time sexual organs are developed, and the closed sac, mentioned above as occupying the posterior portion of the body, becomes ovaries in the female and testicles in the male, and within from eight to ten days from the time of their entrance into the stomach each female Trichina gives birth to living young whose number has been estimated at from two hundred to one thousand from each parent. Whether the same individual becomes pregnant more than once, is not yet fully determined, but from some of the facts observed it is probable that they do. The young Trichinæ are exceedingly minute and thread-like, and commence immediately after birth to bore through the walls of the stomach and intestines containing them, and disseminate themselves with wonderful rapidity all through the muscular tissue. It is a curious fact that they are found to locate themselves only in the tissue of those muscles which are under the control of the will, never having been found in heart or muscles of organic life. After reaching their destination in the muscle they increase gradually in size until they attain one-twenty-fifth of an inch in length, and then coil up in a spiral form and remain quiet in the midst of the deposit of fibrinous matter, which the irritation of their presence has caused to be deposited around them by the vessels supplying nutriment to the

part. This afterwards contracts, enclosing each worm in a separate sac, which is finally in its turn enveloped by a deposit of calcareous matter. The Trichina now remains quiescent in his shell for an indefinite period of time, waiting until some unfortunate animal shall receive him into his stomach, when the acid contained in the gastric juice dissolves the walls of his prison house, and sets him free to give birth to a new generation, who go through a similar cycle of existence, while the parent worm dies and passes off with the intestinal evacuations. It follows from the above observations that the Trichinæ have four distinct phases of existence:

1st. The Trichinæ, when swallowed, stop in the intestine, complete their development there, give birth to young, and then die.

2d. The little Trichinæ, as soon as born, migrate into all the striated muscles, except those of the heart.

3d. Having reached the muscular system they increase in size but not in number.

4th. They become encysted and remain quiescent until eaten by man, or certain animals, when they in turn give birth to a new generation, after which they die.

The symptoms produced by this parasite vary according to the number swallowed and to their different locations in the body, and the disease called Trichinosis may be divided into three stages: 1st. The period of a intestinal irritation. 2d. The period of muscular irritation; and 3d. That of convalescence or termination.

The severity of the symptoms of course vary greatly in different cases. Sometimes the intestinal irritation is so slight as to pass unnoticed by the patient, while, on the contrary, it at other times results in diarrhœa with bloody discharges, with severe abdominal pain, and more rarely in constipation. The tongue is ordinarily dirty and coated. There is nausea, with mucous or bilious vomiting, tumefac-

tion of the abdomen, and in severe cases painful colics. The pulse is always rapid, and the skin hot. The patient hardly ever dies during this stage of the disease. The second period of muscular irritation is always present, unless the number of Trichinæ ingested is very small. When we consider that each female gives birth to four hundred or five hundred young at least, we can understand how a few mouthfuls of the infected meat may give rise to millions of little worms, each of which bores its way all over the body of the patient. This period usually lasts from four to five weeks, and commences with languor and chills, followed by pains in the limbs, and a puffy swelling of the eye-lids and face, which is scarcely ever absent. This swelling often attacks the upper and lower limbs as well as the face. The muscular pains are very acute, and the slightest motion or pressure produces extreme agony. The tongue becomes swollen and painful, and the pulse rises from 115 to 130 per minute, while the diarrhœa often continues, and the abdomen is tumid and tender. Sleep is almost entirely destroyed, and the thirst becomes very urgent. There is often a troublesome cough, which increases the pain and soreness. During this period the patient, if he is able to walk at all, does so upon his toes, as if unable to put his heel to the ground. These symptoms usually abate after from the twentieth to the fortieth day, but the patient remains worn out and exhausted, and the third period, or that of convalescence, is usually long.

Unfortunately all cases do not reach the stage of convalescence. Death often takes place during the second period, or at the commencement of the third, and the patients die with symptoms resembling those of a severe case of typhoid fever.

Thus far it has always been observed that Trichinosis in man has resulted from eating pork, but the hog is not the only animal in which this parasite has been found

to exist. Among the animals in which Trichinæ are found without the intervention of human agency, are: the hog, cat, rat and mouse, mole, badger, etc.; and of birds, the owl, crow, raven, hawk, etc. Besides these, it is found that the administration of diseased meat will produce the Trichinæ in the Guinea-pig and rabbit, and the chicken and pigeon. It has been found impossible to trichinose beef, horse, ass, mutton, etc., in the goose, duck or turkey. Experiments have also been tried on fishes, but with a negative result. It is by no means probable that Trichinosis is so rare a disease as it is commonly supposed to be.

It is not an easy disease to detect, because it has no pathognomonic symptoms. During the first period the symptoms might easily be mistaken for those of dysentery while during the second stage the œdema of the face and limbs greatly resemble the early stages of Bright's disease of the kidneys, and the muscular pains are not unlike some severe cases of rheumatism. The third period has, according to Virchow, been mistaken for consumption. The epidemic of Trichinosis which occurred at Hettstadt was at first considered to be cholerine, while that at Magdebourg was for some time called by a false name.

In a medico-legal point of view, this disease presents points of great interest. The following case will give a just idea of its importance;

In February, 1865, Langenbek operated upon a man at Berlin for a tumor of the neck. During the operation, he remarked that the muscles were filled with encysted trichinæ. Upon asking this man if he had ever had any previous illness, he stated that in 1845, he had with others inspected the schools at Jessen; that eight of them had breakfasted together upon ham, sausage and white wine, with the exception of one who only took a glass of red wine. All the other seven, including the man who had

been operated upon, fell sick, and four of them died. Suspicion naturally fell upon the innkeeper, and an investigation was made without result. Nevertheless the innkeeper continued to be suspected of having poisoned his guests, and he was obliged to emigrate to America. The mortality of this disease is not so great as is usually estimated, as is shown by the following statistics taken from some of the epidemics. At Plauen, two deaths out of fifty cases. At Calbe, seven out of thirty-eight. At Hettstadt, twenty-seven out of one hundred and fifty-eight; and at Bourg, eleven out of fifty.

Virchow arranges the measures to be taken in order to prevent the propagation of the Trichinæ under three heads: 1st. *Preventing as far as possible the infection of swine by Trichinæ.* This can only be done by close attention to their food and cleanliness, for, since we cannot admit the spontaneous generation of Trichinæ in the pork, their presence necessarily presupposes that infected meat must have been taken into the stomach of each diseased hog. 2d. *The meat should be carefully inspected before being delivered to the consumer.* This can only be done properly by means of the microscope; for, to the naked eye, the diseased meat offers no abnormal appearance, except in cases where the parasites have existed in the muscles for a long time, and are surrounded in a thick cyst of calcareous matter, when they may be seen upon careful examination as little white specks. 3d. *Before being placed upon the table, pork should be thoroughly cooked.* It is not an uncommon habit among certain classes to eat the pork raw, in which case the greatest danger, of course, threatens the consumer. But even after cooking or smoking, the central part of a large piece of pork, often does not reach a sufficiently high degree of temperature to destroy the vitality of the Trichinæ, and as now-a-days hams are often sold as smoked which have simply been rubbed over with creasote, pyroligneous acid

or some other empyreumatic substance, we find that eating cooked pork is not entirely devoid of danger. It has, however, been shown by Virchow that a temperature of 210°, or a warm fumigation of twenty-four hours duration, infallibly destroys the Trichinæ.

I have given this short account of the Trichina this evening, thinking that it might be of interest to the members of the Institute, and especially because I have met with two cases of this disease in this city. I was invited by Dr. C. D. Mosher to see two of his patients, one of whom was evidently dangerously sick, and yet presented a train of symptoms which did not conform to any of the ordinary diseases which prevail in this locality. Two boys of German parentage came into the house hungry one morning, and finding a piece of pork upon the table ate some of it raw. The remainder was cooked and eaten by the family at dinner time. A few days afterward the elder boy, aged fourteen years, became sick and vomited several times. Was feverish, and his eye-lids and face were swollen. Then a general soreness attacked his whole body and limbs, which confined him to the bed for a few days, after which it gradually abated, so that when I saw him some six weeks afterward he was quite well, except slight soreness on pressure about the muscles of the arms. The younger boy, aged ten years, was not so fortunate. He, too, became sick a few days after eating the pork. His face and limbs became swollen, and he was attacked with a severe diarrhœa. The muscular soreness became intense, and he walked on his toes with the heels off the ground for three weeks, after which he was obliged to lie still in bed, the least motion causing extreme pain. About this time a troublesome cough commenced, and the effort of coughing increased the soreness. He could not sit up, but remained stiff and extended upon his back. The least pressure

upon the limbs caused him to cry out in agony. This was his condition when I saw him last.

By means of a small instrument, which I had constructed for the purpose, I removed a little piece of muscle from the shoulder of the eldest boy, which I have examined under the microscope, and find studded with trichinæ which are coiled up and quiescent, preparatory to becoming encysted. The younger boy was so tender to the touch that I was unwilling to submit him to the pain of the operation.

Note.—Since the above paper was read before the Institute, the younger boy has died, and a microscopic examination of the muscles showed them to be everywhere filled with Trichinæ, in some of them enveloped in a newly formed cyst, and others free and full of life and motion. In order to give some idea of their number I may state that I counted forty-one trichinæ in a single field presented by a lens of one-inch focal distance.

Art. IV. *The Caucasian Mountains and their Inhabitants.* By G. L. Ditson, M.D.

[Read before the Albany Institute, January, 1869.]

The subject to which I wish to call your attention is the Caucasian mountains and their inhabitants. You are acquainted, doubtless, with the geographical position of these fabled heights and their romantic valleys. Bounded on the west by the Euxine or Black sea, on the east by the Caspian; lying between latitudes 40° and 45° north, and having a climate, when relative elevations are considered, like our own; attaining in some places a height of eighteen thousand feet, and a breadth of one hundred and fifty miles, with a direction through the isthmus nearly northwest and southeast like the Andes and Himalayas, they are physically worthy of study. Formerly, and as laid down in our old maps, they pertained wholly to Asia; but since the Cossac put his iron heel upon their borders, and broke a highway through their barriers, they have become a part of the boundary line between Europe and Asia.

The perpetual snow range is between ten and eleven thousand feet. Grain is grown on the plateaus at a very great height — some seven or eight thousand feet — while tobacco, rice, cotton and indigo are, to a limited extent, produced on the southern slopes where they are sheltered by the great range we are considering. Here, too, the *vine* grows luxuriantly; I have seen it in its wild state festooning the trees for hundreds of feet; the trees themselves being such as we are familiar with, the oak, maple, ash, walnut. The latter yield in abundance, those which we call the English walnut. Game is plentiful, more

particularly in the dense forests that border the Black sea. The beautiful pheasant (of which their are some excellent specimens in our State Geological rooms), is common; at least it formed one of the frequent dishes that graced the table of Prince Woronzoff, the governor general of that realm. There are also myriads of ducks on the waters of the Rion and Kur. In the mountains, bears, jackals and wolves are hunted, and their furs turned to good account. I met one of these four-footed natives. When traversing a plain through upper Colchis on my return from the interior of Asia, I discovered that I was regarded with great interest by a large wolf, a few hundred yards distant. I had a revolver in my belt and felt a certain degree of desperate security. The security, however, was probably very small, for I was breathing more freely when the driver of my sledge, applying his whip with prodigious energy to his good fleet horse, increased the distance between ourselves and our unwelcome neighbor, and I saw that we were not followed. In noting the physical aspect of the country I should have said that the waters of these mountains flow both eastward and westward. The Kuban at the north, the Rion or Phasis at the south flow into the Black sea; the Kur (or Cyrus) and the Terek into the Caspian. It was the *Rion*, so famous in ancient history or fable in connection with the Jason exploits, that I ascended to reach Tiflis, the capital of Georgia; but I had to leave those waters when about two-thirds on the way from the Euxine to said city, as they were no longer navigable even for a row-boat.

The river that flows through Tiflis runs *eastward* to the Caspian; so that the highlands which I ascended after leaving my boat at Marane, and whence the scenery is often extremely attractive, were the dividing line between the two great inland seas, which, on two sides, bound the isthmus. The Kur, or Cyrus, or Kuros, just mentioned,

was named after or dedicated to the sun. Many places, as well as rivers and fountains, were sacred to this deity, and called Cura, Curia, Curapolis, Curene, Cureschata, Curesta, Curestica regio. In Thessalia, we have the river Cuarius or Curalius; others in Media and Persia.

There are now no volcanoes in the Caucasus, but sufficient evidence of their former existence; for the secondary parallel chains on the inner side are largely formed of Plutonic rocks. Argillaceous slate accompany them, while the outer side is of limestone. The central chain is of trachite. There are said, however, to be on the coast what they call *mud* volcanoes. Never having seen any such, I will not attempt to describe them. At Baku, a seaport town at the eastern extremity of this semi-European, semi-Asiatic barrier, the soil is impregnated with naptha; there are also celebrated fountains of the same substance, and it forms an important article of export. As these fountains sometimes take fire, it is believed, spontaneously, the place came to be regarded as *holy* by the Parsees. This, however, was not peculiar to this place. Arsina and Arsiana in Babylonia had fountains of bitumen, and hence were sacred places. Also Arsena in Armenia which had a nitrous lake, and Arsinoe near the Red sea, as also near Ephesus, both of which had streams of bitter waters. An Arabian historian, *Mesudi*, writing of Baku about the year 950, mentions a great volcanic mountain in its vicinity. It can also boast of an oil well, and when on any great festive occasion, an extensive brilliant illumination is required, the oil is poured upon the waters of the Caspian and set on fire.

Quite a variety of minerals, those of the most importance, such as iron, lead, copper, with coal and sulphur, are found in the Caucasus; but I think as yet no gold. Silver, however, had recently been discovered; or as lately as 1848. While I was at the palace of the General, com-

mander of the northern military district, a large pure mass of this metal was brought in by a Russian miner who had dug and smelted it in that region.

The population of the Caucasus is variously estimated in numbers between one and two millions. They are divided into a great many different tribes, belonging to distinct races, and though the Turkish-Tartar language is used as a general means of communication, they speak collectively about a hundred different dialects.

Ethnologically, this region opens a wide field for study, for research, for speculation. The Caucasian variety of mankind, a division adopted by Blumenback, "included all the inhabitants, ancient and modern, of Europe (except the Fins); in Asia, the higher class of Hindoos, the Persians, Assyrians, Arabs," etc., and "the Caucasians." Later writers have made very different divisions. Some from features, classing them with the flat-faced Mongols, some from the radical difference of language. Dr. Prichard makes two varieties of the so-called Caucasian, the Syro-Arabian or Semitic, and the Indo-European or Aryan.

Whatever decision ethnologists may come to on this subject, I am willing myself to believe that we have descended from some of the fine manly races which dwell in these mountains, and I am willing to take Blumenbach's deductions derived from a well-shaped female Georgian cranium in his possession, though it has been facetiously said, that, "Never has a single head done more harm to science, than was done in the way of posthumous mischief by the head of this oriental lady."

The term Circassian has in a wide sense been applied to all the independent tribes within the limits of the latitudes heretofore mentioned. This is not strictly proper. The true Circassians inhabit only the northwestern wing of the range, with the exclusion of the Abhazians. The Turks and Russians call them the Tcherkess, but among

themselves their general name is Adighe. They constitute about one-third of the entire population, and are divided into a dozen or more clans. Of their form of government I cannot speak with much certainty. I believe, however, that with some it is purely patriarchal; with others it partakes of some features of feudalism. One thing is especially worthy of note, that all mountain tribes have a social polity and a characteristic independence and lawlessness, which almost mark them as one family. Among the cliffs of northern Africa, in the Himalayas (which among the Indians signifies the dwelling place of the snows), in these that overlook the Euxine and the Caspian, and the highlands of Scotland, we can trace many and striking resemblances. I will read you a portion of Mr. Chambers's account of the latter, and it will answer for the former.

"The word *clan* was used to designate the freebooters of the border as well as the Celtic tribes of the highlands; and there were two characteristics common to both; their predatory habits and their distribution into communities, each with a common surname." After speaking of an act of the Scottish parliament of 1587, which requires landlords to find security for the conduct of their tenants, he says, "Clans that could find no security were called broken clans, and their members were outlaws. * * The Macgregors were a celebrated broken clan whom the law pursued for centuries with savage ingenuity." * * The following passage in the act of 1581, which virtually authorizes any lowlander, injured by any member of a clan, to take vengeance against all or any of his clansmen, contains a highly-colored account of the social condition of this people: 'The said clan of thieves for the most part are companies of wicked men, coupled in wickedness by occasion of their surnames or near dwellings together, or through keeping society in theft, or receipt of theft, not

subjected to the ordinary course of justice, nor to any one landlord that will make them answerable to the laws, but commonly dwelling on sundry men's lands against the good-will of their landlords, where through true men oppressed by them can have no remeid at the hands of their masters, but for their defense are oftentimes constrained to seek redress of their skaiths of the hail-clan, or *such of them as they happen to apprehend.* Likewise the hail-clan *commonly bears feud for the hurt received by any member thereof*, whether by execution of laws, or order of justice, or otherwise." The highland clans are often spoken of as a feudal institution. * * * "All feudality has a relation to lands from the serf, bound to the soil, through the free vassal who possesses it, up to the superior or feudal lord, who commands services out of it. The descent of all rights connected with it is hereditary. Among the highlanders, on the other hand, the relation was patriarchical, and had no connection with the land, save as the common dwelling place of the tribe."

The clans of the Caucasus were divided into five classes, though their common miseries, misfortunes and dangers, have done much, I think, towards obliterating the lines of distinction between them. The first class embraces the chiefs or princes, who are sometimes eminent as religious teachers. Schamyl, for instance, among this people, and Abdel-Kader among the African Arabs. Then follow the nobles, common freemen, dependents and slaves. Common freemen compose the large majority, have the same political rights as the nobles, and hold property. The dependents serve their lords, or masters, who have no right over their persons, and cannot sell them, unless proved guilty of some crime, by the decision of a properly constituted assembly. The fifth class are those who have been captured in war and are

nominally slaves; but one may rise among them to distinction and power and be another Sparticus.

Respecting the religion of this people, it is said that Mahometanism prevails. This is so, but then I think they mix up with it considerable, both in faith and practice, that has a much higher antiquity than the Medinan prophet. I say *prophet*, because Irving and other learned writers generally so call him; but this is not the proper translation of that most common phrase in the Arabic language which embraces Mahomet's mission; Alla il Alla Mahomet resoul Alla—resoul meaning *envoy*, one sent by God and not a prophet. "God is great and Mahommed is his *envoy*."

Conning the pages of ancient lore in search of the early history of the origin of this tribe or nation, we almost invariably arrive at the conclusion that it is involved in impenetrable obscurity; that like the source of the Nile (till recently at least), towards which we may for a long distance seemingly ascend, it is lost in some vast, sterile, unexplored desert, or springs from inaccessible regions of rocks, girt about with fearful mysteries. One of the obstacles we so often encounter in our gropings for data in dusty antiquity, is brought into our path, I doubt not, by the habit of giving literal construction to the letter of such ancient records as are only symbolical. We read that Prometheus was the son of Clymene and Japetus, and that he was chained to a rock of the Caucasus, where his liver, renewed every night, was torn by a vulture or an eagle. (The liver is still considered by the Turks to be as much the seat of life and love as the heart). Æschylus makes Prometheus the son of Themis Apollodoris Asia. Themis is a mere epithet for earth, and may refer with Apollodoris Asia to a birthplace. Japetus is perhaps intended to signify the origin of the human race. Now may we not, without using any more license than is

commonly taken by interpreters, conclude that this Titan, Prometheus, represents a people of Asia, who by cunning and ingenuity, excited the jealousy of a superior power (that Jupiter represents in this myth), that drove them to the Caucasian rocks and fastened them there; and while their life and energy were renewed by constant additions to their numbers, they were daily harassed and torn by cruel enemies, represented by the vulture and eagle?

About the origin of the *name* of this vast chain of mountains, there is a wide difference of opinions. The term is foreign to its people, and is thought by Klaproth to come from the Persian *Kohckaf*, which signifies the mountains of *Ckaf*. By the Turks these mountains are called *Ckaf-thagi*.

The *Adighe*, applied by the Circassians to themselves, is said to be derived from *ada*, which in Tartar language corresponds to island, but a learned writer declares that the Circassians have no word for *island* in their language. That this highland, however, had once the appearance of an island, there can be no doubt, for there is incontestable evidence that the Caspian, Black and Azoff seas were formerly one, while the Ural lake can be considered as only a fraction of the former. The whole triangle between the Don and the Volga, with the Caucasus for its base, is a low, saline, sandy plain, covered with shells and other evidences of its having been submerged, in which case it must have connected the seas just named.

This may account perhaps for the fable, that Prometheus, as king of the Scythians, had his country wasted by a *river* named Eagle whose inundations he was unable to prevent.

There is a tradition in Asia, that when the earth was given to Adam, the people anterior to him were exiled to the Caucasian mountains. The same oriental tradition has it, that colonies went from the Caucasus and spread

themselves over neighboring mountains. This is supported by agreement with others which state that the ancestors of the generations which cover the great plateau of Tartary, the vast Scythia of the ancients, Persia and Asia Minor, were descended from the Caucasus.

Still the question recurs, who were the original inhabitants of this realm? It is a natural supposition that they were one people, speaking one language; but history does not fully sustain this idea. The Caucasus was rather a refuge for the oppressed of all nations. From a discovery made by Mr. Biberstein, in the Georgian chronicles, of an account of an invasion of Magogs at precisely the period in which Herodotus places the invasion of the Cimmerians, it has been inferred that they were the same Tartars or Mongols (bearing a name signifying *heathen*, and whom by prediction the Jews were to destroy), driven out of Tartary by the Scythian into the Caucasian mountains, whence they descended on Asia Minor about B. C. 950. Dr. Clarke says: "The Tcherkessi continually repelled from their ancient boundary, the Tanais and Lake Meotis, and ultimately driven beyond the Kuban and Terek, hung on the northern sides of the Caucasus." Pallas says: "That the tribe of Cabardians consider themselves as descendants of the Arabs;" and adds that the Abhasians are distinguished from the neighboring natives by their faces, by the figure of their heads which are compressed on both sides, by their prominent noses and dark brown hair." The same author after giving cogent reasons for supposing that the Amazons were not a fabulous race says: "It is obvious that they and their husbands (which they eventually took, at least for a time), lived in Cabadar of the Caucasus." As they were Sauromatians from whom probably are descended the Ossetis who resided further north and are the Alanes of the middle ages, it plainly appears that the Amazons, Mœtians, Sauromatians,

Alanes, and Ossettis belong to one of the same race of the descendants of Japhet.

We have not time to pursue this branch of the subject any further.

The costume of the Circassians like that of the orientalists generally, is, as you are aware, extremely picturesque. But toilets differ there as they do here, and wealth and poverty make their respective marks in the *chaumiere* of the lowly and the *sarai* of fortune's favorites. When circumstances permit, the large pantaloon of silk are an indispensable article. The number of breadths they contain would almost seem to indicate the number of dependents pertaining to the wearer. Drawn in rich folds about the ancles (apparently), they give to the feet a diminutive appearance to which ladies are never averse, I believe, in any country; and as females ride on horseback there as the men do, this article of apparel is as useful as ornamental; and I might add, incidentally, that a cavalcade of this people, met with sometimes in the passes of the mountains, startles one with its wild and gleaming beauty, and will live in the memory till all its records are obliterated. The loose jacket with open sleeves, often richly embroidered with gold, covering a silken vest with like elaborate ornature, has also its dainty dazzlements. These are left slightly open in front from the throat to the girdle and have there a bordering of braided hair or long silken tresses brought forward for that purpose by the fair wearer — raven tresses and long flexible braids, inwrought with threads of gold. Their feet, often unstockinged, are kept with great care, and play their role in the arts of coquetry as the white arms of the Syrian women did in olden times when with sounding cymbals they danced to the joy and melody of their hearts.

Their feet, I have said, are kept with great care, and among the higher classes are beautifully delicate. This

arises from the habit of leaving off their slippers when they seat themselves upon a rug on the floor, or upon a divan where they draw their feet up in front of them somewhat *a la Turque.* Toes, you would probably say, are not a very poetical theme, yet I can imagine that a young enthusiastic poet could and would write many a welcome verse on these little, despised, imprisoned, appendages — this wondrous fringe to our pedal extremities — had he but one glimpse of them in their untormented license of action, in their blushing freedom, one view of their sculptured perfections, of their dainty dimpled physiognomy as they peep from under folds of ample drapery of oriental damsels; but I am not aware that in Circassia they are ornamented with rings of gold, as are those of Armenian ladies, at least in India.

In the smaller villages of the mountains, the dames go abroad unveiled, but in the large towns they are enveloped from head to foot, usually in a blue striped cotton garment kept in place and made to conceal, in part, the face by being held in the mouth. Yellow morocco boots complete the *visible* street costume.

This out-door garb, you can imagine, is anything but attractive; makes the wearers what their fathers, husbands and masters wish them to be, undistinguishable, perambulating monuments of other peoples' personal property. But when one of these ladies is richly attired, and has a little vanity — and who of us has not? she is apt to allow (by accident of course) one or both sides of her uncouth covering to slip from her lips, and thus give to the passer by a view of her elegant costume beneath. The headdress of this class, when within doors, is generally a close-fitting crimson cloth cap embroidered with gold thread or bordered with a band of small gold or silver coin.

The attire of the men is not less picturesque, and when we contemplate their fine forms, their manly bearing,

their chivalric deportment, our admiration keeps pace with their historic fame, and the sublime fortitude with which for centuries they have defended their mountain homes. The arms they bear form always an attractive feature. Seldom one is seen without the Circassian knife, of world-wide reputation, shining handily in his belt; or, the still more famous Damascene blade, hanging at his side.

Some still carry the long bow and arrow, and know how to use them very effectively, while others wear a brace of highly ornamented pistols. The long Turkish gun is also a favorite weapon with them, and many a poor Russian, when least expecting it, has received from it his death warrant. If they have fire-arms they wear on each breast a row of cartridge tubes, for their cartridges of powder. These are not a little conspicuous, lying neatly arranged on the white ground of their well-fitting overcoats, are very handy in case of need, and might perhaps say to an enemy, as Rogers has so beautifully done in one of his artistic groups, seen in our shop windows, "One more shot."

The common head dress of these warriors is unlike any I have seen in any other country. It is made of goat skin, well prepared, well fashioned, and its long black silky hair falls about the face and neck, thoroughly protecting them in the bleakest of bleak weather among the snow-bound cliffs of the Caucasus.

These hardy men — and I may well add the women too — are cavaliers of the true Arab type; bold, fearless, graceful; but this is a part of their training, a part of their early education, and to this they are much indebted for their successful assaults upon the Russian troops and their masterly retreats and dispersion, when their ends have been accomplished. Their horses should not go unnoticed here, for they too have been trained to climb

like goats the wierd and rugged paths that lead from ravine to ravine and from cliff to cliff. I have had some experience myself with these fine animals, one having swam with me across a dismal lagoon and carried me safely in the darkest of nights through a dense, tangled, pathless forest. I have also ascended the old Syrian mountains on horseback, the beast, like these just referred to, making his sure way up steps that had been cut in the rocky declivity; and it is at such times, if ever, that one becomes attached to his four-footed companion, for you cling to him then for safety and he does not disappoint you, and your memory returns gratefully to him when years have glided away.

With such tribes as these of the Caucasus, with such means of escape, with such *almost* inaccessible homes, can you not imagine with what terrible difficulties, with what loss of life, with what expense, suffering, and sometime humility, war has long been waged with them by the Northmen. And this struggle has at times been carried on, *apparently* in mere sport; but we know that the Russians are not a cruel, but a generous, hospitable people. I am aware, however, that a military expedition was gotten up and sent into the mountains against Schamyl, the Garibaldi of that realm, to please a distinguished Frenchman. This foreigner, doubtless, wished to see, to know, all the details of these desperate raids, that he or his master might use the same, if effective, against the Kabyls of Algeria with whom the French were then waging a similar warfare.

Had the propriety, or humanity, of this thing been questioned, the reply doubtless would have been, that sooner or later it would necessarily have taken place; and that ordering it and putting it into execution at that particular time, was merely precipitating the affair, and hence could not be a subject of censure.

This expedition was a failure, as most of the kind were; the Russians retreating with great loss; and, from what has been said, it is easy to see why this should be so, and why for so many long weary years, numbers of these mountain tribes have maintained their independence.

In connection with one of these raids in the earliest years of the invasion I will relate a story. In the villages generally, it had been noised abroad that the Russians in large force had left Tiflis and were ascending the great military road which led up into, and through the centre of their territory. This was enough to rouse every native, and horses and arms were at once looked to, and every thing gotten ready for fight or flight, but no signal fire had yet been lighted to give them positive warning, or summon them to some preconcerted rendezvous. Watchers were placed at every available point, and scouts sent out. Finally, when the invaders had proceeded about twenty miles, they turned from the main road and entered a by-way. This indicated the quarter or district that was to be attacked, and from the highest peak of that region soon blazed the first signal fire, that ere long was responded to from far and near, till the heavens reflected the blaze of a thousand warning lights. It was immediately agreed upon, that the villages should be deserted by all the men, and that the women were to entertain the enemy courteously wherever they came, and thus avoid, if possible, the burning of their houses. The first town entered by the Russians was to them the most unfortunate one they could have encountered, for it was more famed for the beauty of its females than any other from the Euxine to the Caspian. The colonel commanding the troops, and all the minor officers, were utterly bewildered, and allowed themselves to linger over such entertainments as the fairest of the fair could hastily provide for them. In the meantime the Circassians were gather-

ing in the rear of the Russians from every quarter. A consultation was finally held by the officers of the invading force — themselves the willing captives — and the questions which naturally arose were these: "Can we with any sort of honor, burn the humble homes of these peerless creatures who have so heartily welcomed us? Should we proceed further into the interior of the country when we are assured that every village like this has been deserted? Can we fight and overcome an enemy where none is to be found? Negative answers very naturally followed, and when further delay would have exhibited a too apparent weakness of character, a retreat was sounded. Then the long and almost interminable line of the Russian forces began to rethread its way down the narrow gorges whence it had come. When the last of the column had left the town, and the colonel for the tenth time had bid adieu to the most gorgeous of the gorgeous Circassian belles, a signal gun was fired which found an echo in the hearts of the thousands of mountaineers who lay concealed along the way of the now careless, unsuspicious, receding troops; and had the escarpments of rocks on either hand closed upon them they could not have been enervated more effectually than they were, when from every acclivity, every crag and ravine, hot, flaming, hissing missiles of death descended like a shower of hail upon their devoted ranks. Escape was impossible. Those in the rear could only push forward by trampling on those in front, and those in front were shot down so rapidly, that the ravine was bridged with the dead.

When I was in Africa a similar expedition was set on foot by Marshal Randon against the Kabyls of the Atlas. This was successful, for the commander pitched his tent upon the plains and sent the Zouaves to assail the heights, and the ægis of beauty threw no fictitious shadow over the slaughter.

The domestic life of the Circassians cannot, in a short paper like this, be fully portrayed. I must, however, touch upon those habitudes which mark them as a peculiar people. In the first place, *education* is hardly known among them. There may be a village schoolmaster who teaches the *boys* to read and write sentences from the Koran or from the Zend-a-vesta, the sacred book of the Guebers and Parsees, for there are still some fire-worshipers among the Caspian cliffs of the Caucasus; but a well educated person is probably not to be found among any of the tribes of this entire territory. The girls are especially neglected, for the men say they cannot see of what possible use learning can be to the gentle sex; and, situated as they are, ignorance *may* be bliss. But fancy if you can such a state of things and the necessary sequence. If they were of a low type, like those in the interior of Africa, our dreams of a mundane paradise and a millenium would be banished both from our sleeping and our waking hours, and a gloomy grave for humanity would seem to open before us; but here are a people with finely shaped heads, and large well developed brains, and what is to be done with them? If one cannot read, and there are few or no shopping exactions, no pleasant streets for a promenade, what remains but domestic cares and the *toilette?* For these then they are valued, and for these alone, though in the word *toilette* I would embrace that beauty, abstract or otherwise, which its arts are designed to enhance. That they are strong, healthy wives, careful, affectionate mothers, I cannnot doubt; and it is possible that their position may be an enviable one, if we compare them with the picture recently drawn of our fair Christian sex, by the able and elegant writer, W. R. Alger; for he says, "There never were so many morally baffled, uneasy, and complaining women on earth, as now, because never before did the capacities of intelligence and

affection so greatly exceed their gratifications. New perceptions are the scouts of fresh desires; fresh desires precede their own fulfillment; a just reconciliation is a slow, historic process. The lives of a multitude of women all around us contain a large element of unsuccessful outward and inward ambitions, vain attempts and prayers. This drives them back upon themselves into a deeper and sadder seclusion than that naturally imposed by their housekeeping, and their historic withdrawment from the bustling business of the world."

When poverty, hard labor, scanty fare, grapple with the delicate sensibilities natural to women of all countries, in Circassia as well as elsewhere, melancholy forebodings, sadness of the face, deep depression of spirits necessarily ensue; and here we may find the cause and some of the consequences of the enslavement (so-called), of the Caucasian damsels. To this I shall return again.

This people, I have said, are universally steeped in ignorance, and they are as universally poor, as all warlike tribes and people are. The fine arts cannot thrive in such an atmosphere, hence their entire absence, and the want of their refining influences. Sculpture, painting, the higher elements of music and poetry, are not the children of fierce, hostile camps, of low, smoky huts, of earth-caverned hovels; they haunt and hallow the sanctuaries of refined tastes, and breathe their inspirations through the tents of peace.

The men here think first of their horses, then of their arms, then of their wives and children. The women think first of their costume, then of their domestic duties. If they have any music or poetry in their souls, it may burn for a moment in their beautiful eyes, then sinks away under a sigh of uncomprehended longings, but never breaks into its legitimate metre, never soars into that divine expression which sings itself through the ages.

Besides weaving cloth from the wool which they themselvs have prepared, making the garments required for the household, they have much of the out-door work to do. This devolves more particularly upon the oldest, the worn-out so-called, women, while the younger are kept with considerable seclusion, are regarded with no little jealousy. The dress, too, of these females who are termed *passe*, is often disjointed, scanty, neglected; while that of the unmarried, or the newly married, is in the blending of colors, in jauty grace, in brilliancy of effect, all that exquisite feminine taste can possibly make it.

The out-door work that I have alluded to, consists principally in attending to the sheep, goats, cows, in bringing wood from the wooded heights, and hay, which perhaps they had cut and stacked.

The architecture of this people would not particularly interest a poet, nor hardly a common pedestrian. The Georgian style in many places, though there are noble exceptions, is no better, is indeed similar in every respect. I remember having passed a place a great number of times and never having had my attention attracted to it except as the natural declivity of a small hill or embankment on the southern side of a broad, dirty, unpaved street. One day, however, much to my astonishment, I saw a door open at its base and quite a family issue from it. On the eastern banks of the Kur, almost in the very heart of the capital of New Russia, many Georgian families live under ground or nearly so; live in excavations made in the hill-side, where nothing is required but a roof; and this roof, after being timbered, is often covered with the very sods that had been removed from that very place. A gentleman told me that he once rode along over some of these habitations and was not aware of their existence till his horse fell through one of them.

Throughout the Caucasus the various tribes take advantage of these ever-present slopes, dig into them, and make there their warm but sombre and smoky abodes. One village that I visited near Vladi-Caucasse, on the *northern* side of this giant range, stood on level ground, was built mainly of wood, of sticks and stones, dried clay and straw, one-story buildings, low at that, and thatched.

The best families construct a number of edifices in such a situation as to form a hollow square; *all* the doors, and windows if there be any, open on this engirded area, which affords at night quite a secure place for the flocks and herds of the proprietor. The only access from the street is by a gate-way, always kept closed. Near this entrance is the master's house, hall or apartment, while the dwelling for the women is on the other side of the yard. In a visit to one of these enclosures — not particularly neat or attractive — I saw at an open window opposite, two heads as pleasing, and as pleasingly decorated, as you would expect to see represented in the finest of oriental paintings.

It reminded me of our lilies — for the Circassian women have fair complexions — of our delicate pond lilies afloat on the turbid waters of a filthy stream. They must indeed be the oasis in that strange, thought-sterile, desert-life; the light, the poetry, the music, in that wild, weird wilderness of ideas and ideality.

Another house which I entered in Vladi-Caucasse, had a very low thatched roof and two rooms. The room nearest the street was extremely dark and full of smoke. When I could see, I discovered that a considerable portion of the apartment was occupied by a huge oven of clay, at which an old, poorly-clad woman was baking bread.

The sister of the young man who was my guide there, favored us a moment with her presence; but in accordance with their education, instinctively it would seem,

shrinking from the presence of strangers, she in a moment timidly retreated to her own windowless dormitory.

Another village in a narrow ravine where I passed the night, and where the Russians have a post-station — for it was by that great military road I have before referred to, through which pass all the troops, couriers, mails, from St. Petersburg and Moscow, destined for the capital of New Russia, Tiflis, in Georgia — it was there I was agreeably surprised at the neat and cheerful aspect of the dwellings; and was forcibly reminded of the English James Town, nestled under beetling cliffs, from four to eight hundred feet in height, in a rent in the rocks of the island of St. Helena; that colossal monument nature seems to have reared for the tomb, and to perpetuate the memory of the greatest of modern heroes — adding one more to the numberless marks of infamy with which the English nation has been branded.

The apartment of the lord of the manor and that of his wife and family, are, as I have indicated, separated by the court-yard; that is, where the proprietor is wealthy enough to build more than one edifice; for his dignity would be lessened, would be seriously impaired, in fact, should he appear to admit, at any time, any of the gentler sex on a plane of equality with himself. As helpmeets indeed, yet inferior; idols, it may be, yet to be broken and spurned at will like one of potter's clay; mothers of their children, yet their servants or slaves; companions, if we insist on the name, yet only when night has put an end to the strife of war, to raids upon neighboring tribes; when the horses have been housed, the leashed dogs loosened, and the pipe smoked with equals; such and no more, for education and immemorial custom raise here their adamantine barriers which no religion pierces, no social habitudes surmount, no sentiment, no moral enthusiasm, no love breaks down. A Magdalen

may walk with unsandaled feet the thorny path of duty, but her triumph must be of the soul, an inward exaltation, looking with resignation and trust to that ever beaming star of Bethlehem circling unwearied round the mountain of her faith, fadelessly above the clouds of her plaintive pilgrimage.

Here I am reminded of a feature in the moral code of this people, and with which there is connected a rather ludicrous custom. I say in the moral code of *this* people, but it exists among the Kabyls of the Atlas, among the Arabs, and I believe also, among our Indians, and among the highlands of Scotland as we have seen. Where one person causes intentionally the death of another, the brother or nearest relative, or some one of the same tribe as the deceased, is bound to avenge it, and the murderer must pay the forfeit of his life. The *night* time is generally chosen for seeking this redress, and as these mountaineers are constantly making raids upon each other, almost every man can boast of having caused the death of one or more of his enemies, and hence at any moment is liable to receive the customary reward. When one then is about to sally out to visit his family, he first hangs his cap on the end of his cane and thrusts it cautiously, as if his head were in it, out of the door; if he receives no bullet in it, and hears no report of a gun, he ventures forth.

Marriage among this people is neither a sacrament nor a ceremony of much moment. When a father says to a young man who solicits the hand of his daughter, "I have supported this child for fourteen, fifteen, sixteen years or more, and you would have me give her to you as if she were some worthless game, some wild bird that had flown into my hut, and had cost me nothing. You must be a mad mountain boor to think of such a thing.

Give me a gun and the powder I need, a cow, and the finest horse you can find in the country and she is yours."

"You know, dear sir," he replies, "I have not these things and have not the means of buying them."

"Go then and fight the Letsghini, the Tcherkess, the Mingrelians, or any other of our enemies and take from them what I require."

Love may make here a daring, a fearless warrior, when nothing else, perhaps, would, and the young man claims his bride sooner than might be expected; and this is called a sale. Should we throw stones at such before looking at home, and observing how much of this loving humanity is bought with gold? If, occasionally, mid the desperate feuds of these tribes, damsels *are* stolen, carried off and distributed among the victors, or sold, they have at least one consolation, which is, they might be worse off at home.

As a further illustration of the painfully low and humiliating condition in which many of these people exist, I will state, in brief, what occurred on my way from the Black sea to the region of which I am speaking. Ascending in a small-boat the Rion, that old historic Phasis, before mentioned, where the Argonants went for the golden fleece; as we could not advance after dark, our little craft was fastened to the shore and we either slept in it, on our blankets on the bank, or in some neighboring hut, if there chanced to be any.

Several times we passed the night under a native roof, and invariably found it sheltering extreme poverty. One only I will particularly designate. It consisted of a single room surmounted by a high conical roof of thatch. The walls were low, and of clay, and the only light it had by day was that admitted by the doorway; and at night that flickering uncertain gleam which faggots throw up to make darkness visible. In the centre of the room, on

the ground, the floor nature had kindly provided for them, the fire was built. To economize heat, there was no chimney to this primitive saloon, the smoke, consequently, was equally economized. The cooking utensils consisted of a single kettle, and in this there was being cooked the only article of food in the dwelling — a dish of beans. There was no bedding; the people did as we did — wrapped themselves in what clothing they possessed, and lay down on the broad wooden divans or benches which ran along two sides of the apartment.

Two women and two children graced this wretched shelter. We were hospitably received by the former, though a certain amount of diffidence characterized their movements, for they seemed to feel conscious of the poverty of their attire. Each wore a long blue cotton gown and a scarf or handkerchief about the head; but the lack of a gay or costly garb could not eclipse the glory of inimitable beauty or faultless forms. The face of the mother of the children was almost divine. No sculptor could have done it justice, and only some inspired painter could have reached the height of its calm, its classic, its chaste perfections. Her brows were beautifully arched; her eyes were large, seemingly deep blue, full of sad eloquence and tears. She raised her hand and her finely chiseled arm was revealed; for there fell back from it a wide open sleeve, which she took, and with it — will you pardon me for stating a very simple fact? — wiped her nose. But I have not said what I particularly wished to in regard to this visit. In the morning, before our departure, the poor mother offered me her eldest child, a kind, gentle girl, some ten or twelve years of age, saying to me through the Georgian Colonel Cargonoff, who was my companion, friend and interpreter, "Take her I pray you, for I love her dearly, and the more I love my children the more anxious I am that they should fall into the

hands of such as are able to take care of them. If she remains here she must marry some poor boatman as *I* did, and her whole life will be one long wail for bread, and the ordinary comforts of life. Toil, toil, will be the burden of her morning, her mid-day, and her evening song; and at night, weary as she may be, she must find her rest on these hard boards, such as you see around us."

When in memory I wander again in that far-off land, I often think of that poor woman, willing, in her deep love and tenderness to part with her child, and perhaps never more gaze on its delicate face, all mother in its classic lineaments, its gentle expression, its tearful hope; never more, perchance, even *hear* a word of her first-born; whether in sunshine, in soft chaste gladness, she danced away the hours of golden-slippered existence, or in the depth of degradation, in wretchedness of soul, she turned her garments of simplicity and faith into rags of remorse, and lay down in the early grave of the most unfortunate.

Perhaps it would be unmanly in me to say that my eyes have more than once been filled with tears when contemplating the sorrowful life of this unique, this strange people; and when I have thought of their limited means for education and enjoyment, or rather their lack of all means, of every resource, for successful intellectual culture, I have turned with a grateful heart, and perhaps, some pardonable pride, to our own glorious institutions.

It is not to be supposed that you will appreciate this as *I* do, for you all may not have seen a whole nation slumbering in the darkness of a rayless, pitiable ignorance. You, perhaps, have never thought of comparing our varied means of enjoyment with those of the untutored of whom I have been speaking. It is, indeed, like comparing the dead with the living, the fertile summer with sterile winter. We revel in the splendors of an ideal garniture, which from

its universality and common aspect, we cease to prize, or even heed. In the realms of poetry, music, painting, sculpture, the sciences, history and romance, what fragrant flowers, what glistening streams, what emerald banks, what sunny slopes, what embowered paths, greet us as we advance. Every step has its compensating joys and smiles, but like the inevitable sun and the stars, the eternal belt of light that girds us as we walk, and envelops all our life, they come as a matter of course, and their worth gains nothing, let me repeat, by comparison, forgetting as we do, the shadow that falls on the other half of the mental world, the capable but dormant intellects of our fair unfortunate sisters of the dreamy orient.

Our memories are studded with priceless gems, our soul-treasures are innumerable, and though the graces of culture, the charms of knowledge are of ancient heritage, they are no less precious.

We have not fully comprehended the import of those gods and goddesses that stood at the portals of the Grecian temples. If it had all been engraven on their pedestals, how long would it have taken each comer to read it? Such a record was not needed. Each figure was replete with a mute eloquence, felt and comprehended by all. Diana, Apollo, Mnemosyne, whose children were song, memory, and meditation; Clio with her laurel wreath, her stylet and papyrus; Euterpe crowned with flowers; Erato with her lyre; Calliope with her book of gold. *There*, stood breathing ecstatic grace, celestial harmony, wild fleet joy, placid empire, rapturous sentiment, fountains of thought, feeling, mental fertility, emotion, ravishing ideality, peace, concord. The wise weighed well their actions in the marble scale of justice, heard notes of harmony on the silent flute, and took sage counsel from the book of gold.

I wish now to return to a subject which I have several times touched upon, but have not fully explained — Circassian *slavery*.

Let me at once say, that here I have no picture of woe and despair to present to your imaginations; none of those horrors to portray, which you naturally attach to that odious word. The Russians at first (having then only possession of the sea-board), entertained on this traffic, so-called, pretty much the same opinions as we do, and occasionally captured a *sandale* or boat-load of Circassian damsels on their way to Stamboul; but I think they finally lessened their zeal, except only from political motives, when they came to understand better its true character. The arbitrary measures of the invader were, in fact, just such as we suppose *Massachusetts* would have adopted under the circumstances; for that state seems to have taken upon itself to regulate the moral and political status of this small world.

Some years ago, in this country, quite a number of young women banded together and sailed for California to better their conditions; it is somewhat surprising that Massachusetts did not have them all arrested, and, having distributed them among themselves as their servants — mere servants to whom they should pay nothing because they were *rescued* — all of course for the glory of religion — rescued from some great *possible* gulf; having, I say, taken them as servants, they would consider their captives sufficiently honored, and give thanks accordingly. It would have repeated what Russia has done in the east. I will single out only one instance. On board a boat on the Black sea, my attention was particularly called to a young girl who had been thus taken and given as a serving maid to the wife of a Russian official. I had the opportunity of noticing her one whole day, as, in a Russian steamer, we coasted along under the frowning cliffs of

the Caucasus, where, in some of its ravines, nestled the humble cottage of the little captive. Byron's words of the dying gladiator, breathed there then, their sad music through my memory. Do you suppose this *rescued* child to have been happy? I could read on her face a painful discontent; that her fair young hopes had been blighted; that her almost infantile dreams, which like bright winged humming-birds had flitted about her pillow, had vanished; the sultana's garb and jewels had turned into the drapery of servitude.

I have mentioned this California expedition because it happened to be a parallel case with many in the Caucasian realm which are stigmatized and loaded with all the epithets that can harrow up one's soul, and fill the heart with grief. I have said enough to show you how much more beautiful our life is; but I speak of things as they *are* in the orient, as they must be with their necessary surroundings. You cannot make the lily of the valley thrive on the bleak mountain tops. You must prepare a congenial soil and atmosphere; then you may begin your transplanting.

To return: I *knew* of two young women of Mingrelia, on the banks of the Phasis, persons of considerable beauty, who told an acquaintance of mine in Tiflis, that they were going voluntarily to Stamboul, our Constantinople, as soon as one of these slave expeditions was inaugurated, and they could avail themselves of it. Now, if on their way, full of hope and joy, full of the belief that they were to better their condition — that same belief, hope and trust, which multitudes of our own country-girls have when they go from their staid homes on farms, to large and brilliant cities; now I say, if on their way, these two Mingrelian sisters were captured by the Russians, deprived of their liberty of action, and made servants of,

where is the justice, and whence the questionable good to be deduced.

If these two sisters, on their departure for the Bosphorus, had taken charge of that destitute child who was offered to me; and of another, still younger, and still more attractive, whom I also saw in a hut in Abhasia, would the lot of these little ones, with any degree of probability, have been worse, more hopelessly wretched? Moreover, when free, is there not always in the human soul a little star of bouyant expectations, of cheering faith, that rises o'er the verge of all life's sad forebodings?

Again, the hopes of their families often rest on these departing ones, from whom, indeed, thousands of blessings and comforts have heretofore flowed homeward. When a daughter sets out for Stamboul with a fair prospect of reaching that Eldorado in safety, she leaves a ray of sunshine in the house; for the parents look forward with confidence to the time when they shall hear from their child, and perhaps receive from her some of those bags of gold we read of in oriental romances. There is perhaps not a mother in all the land, from the Euxine to the Caspian, who has not sometime or other had the possible thought, flit through her reveries, that *her* daughter may yet be a sultana, for is not the mother of the sultan a Circassian?

If Spain is proud of having a daughter sit on the throne of France, they have no less pride in saying, "Our daughters have long been the queens, the very glory of the Ottoman empire." There is, we all know, a halo about this princely power that diffuses itself through every land; the very peaks of the Caucasian mountains have not escaped its influence.

I have said that blessings and comforts flow homeward from this exodus. The Irish afford us an illustration. Independent of the money and clothing, rich

silks, cotton goods and various wares, which find their way from the city of the sultan to these sterile cliffs, the sandales, which bring to the former that gentle, fluttering, living freight we have been contemplating, carry back those arms and ammunition which have enabled the Circassians for so many years to maintain their successful war against the Russians.

In this last named traffic, lie the strongest incentives the invaders have to stop the Circassian slave trade; and if they can be persuaded by their priests that it is for the good of the souls of these willing emigrants to have them arrested and made to serve involuntarily, those whom they detest as the desolators of their homes, the murderers of their fathers and brothers, of course the *moral* influence is presumed to be the paramount one; and perhaps the generous large-hearted Russians persuade themselves that it is so.

God's light falls mid the deepest shadows of a tangled forest; there are germs of beautiful life in the meanest sod of our common earth; should *we* not then look gently, compassionately, affectionately even, on those compelled to live so far beneath our own good fortunes; for they have souls, but only sparse and flickering light to make them lovable; they have capacious intellects, but no golden book of wisdom in which to read of higher, brighter things.

Art. V. *Frogs, and their Contributions to Science.*

By John V. Lansing, M.D.

[Read before the Albany Institute.]

The little tail-less animal we have chosen as the subject of this evening's paper, has few attractions of form, is quite retired in its habits, and stands not very high on the scale of animated beings. To most persons indeed, there is usually something forbidding in the appearance, certainly something repulsive in the touch; while the common thought thinks of frogs as it does of reptiles, such as snakes and lizards, as things to be shuddered at and avoided.

A moment's consideration, however, of the position they have occupied in the world's history, thoughts and progress compared with more pretentious animals, removes from them the idea of insignificancy, invests them with exceeding interest, and even dignifies their creation as having been designed for special, wise and holy purposes.

They figure by no means meanly in mythology, in ancient song, in sacred writ, and in later years prominently upon the page of science.

We learn from Esop, the classic and accomplished animal linguist as well as naturalist, some facts in regard to frogs in their social and individual relations, that we could not have learned in any other way. We learn that they were originally democratic in their government, and happy in their condition, but like mortals touched with feelings of vanity and ambition, they became discontented and sighed after royalty, and that Jupiter yielding to their wishes, gave them a king in the shape of a cruel stork, who, while he reigned over, amused himself by devouring

his subjects. Frogs have been essentially democratic ever since, as their free speech and seemingly equal rights in the pursuit of animal happiness testify.

Homer, the broadest winged of the Grecian poets, did not deem them unworthy of his song. The battle of the Frogs and Mice, Βατραχομυομαχια, will live as long as the story of the siege of Troy. Once are they spoken of in sacred history and though in a way not pleasant to think of, as a plague, yet as the ministers of God, to turn the heart of Pharaoh, we invest that croaking army of frogs that came up from pool, and river-side, and covered the borders of Egypt with all the awe and sanctity of a divine mission. However poorly esteemed, they can never lose the sacred character attaching to them, from this fact, that they were once selected as the special instruments of a divine purpose.

The geological record of animal forms, that lived unnumbered ages ago, unfolds here and there a fossil representative of the class we are considering. In those days of exuberant vegetable and animal life, batrachian forms of wondrous size and beauty perhaps, lived and sported, and departing left behind them foot-prints if not on the "sands of time," yet, most certainly, on the new red sandstones of Saxony and Connecticut. Admitting their antediluvian existence, it would not, from our knowledge of their natant powers, require much imagination to suppose them independent survivors of the flood, did not plutonic action and a probably high temperature of water — for the frog dies at 107° F. — forbid the idea. I have read that in a German museum there is a single specimen, that was found imbedded in amber, and that this is the only known instance of an antediluvian amphibian, that has come down to us, with its external characteristics preserved. A fitting entombment this, in fragrant

golden-colored, pellucid amber, of the only representative of his race as it lived in primitive and prenoachian times.

It is proper here that we should assign our subject its precise zoological rank and position. Until recently, following the division made by Cuvier of the vertebrate animals into four groups, viz: Mammals, Birds, Reptiles and Fishes, frogs were classed with reptiles. We are glad, as well for the name of the thing, as for its greater scientific accuracy, to have them now ranked in an order by themselves, that of amphibia, allied only to reptiles on the one hand, and fishes on the other. Strictly speaking, however, they are not capable of a double life in air and water, and therefore are not like the Banded Proteus, of pure amphibian nature. It is true, the early tadpole portion of their existence is passed in water, and respiration effected by gills; but lungs and gills are both necessary for respiring in either element. The frog dies if long enough immersed in water, and the tadpole quickly in the air.

Rana, the Latin name for frog, designates the genus under which he is classed, while under the family name of Ranidæ, resembling frogs, we find included several other genera of which the common garden and tree toads are types. But it is with the genus *Rana*, that we are concerned, or rather with the single member of that genus known as the *Rana fontinalis* or *Rana esculenta*, the common spring or green frog. In doing this we pass by the attractions of that sturdy denizen of our pools and lakes, the sonorous, rana pipiens, the bull-frog, the "bloody noun" of our school boy days, the lithsome leaping leopard frog, the *Rana palustris*, and his sober drab-coated brother, the wood-frog, the *Rana sylvatica*.

The proper study of mankind, that is, of the animal man, begins with his frame work, and after mastering this, rises to the consideration of his organic life. His habits, intellectual phenomena, and the philosophy of his being,

become thereby less difficult to understand. In a somewhat similar, and yet by no means scientific way, we propose to study frogs.

The skeleton of the frog, if placed upright, has a sufficiently human appearance to pass at first sight for that of a lilliputian child, which had been affected by some disease of the spine. There is certainly enough resemblance to permit the use in masquerade or comic woodcut of the batrachian form as the basis of caricature, a thing which cannot be done with many other animal forms.

The maxillary bones differ from each other, in that the upper alone is furnished with teeth. These are set closely together around the jaw, not springing from alveoli, but implanted on the bone. They number forty-two, with eight placed traversely on the vomer, called the palatine teeth. In taking their food, there seems nothing like mastication, the teeth serving rather as prehensile agents to prevent the escape of the struggling insect although to a certain degree the palatine teeth must triturate it, as pressed upward by the tongue it passes into the esophagus.

The cavity of the cranium is quite small, and we cannot claim for the frog from its phrenological developments, a large degree of intellectual power. It is sufficient, however, for all the practical purposes of his being. His perceptive faculties are good, as shown by his capture of insects in their rapid flight upon the wing; his judgment as to distances tolerably accurate, as shewn when disturbed on land by his reaching his haven of water by a single leap; he has a quick ear to apprehend danger, and one seemingly appreciative of his own music, and he is eminently sociable with his kind in the spring time of the year, and also during the season of hybernation.

His spinal column is made up of nine vertebræ, all of which, except the atlas, have long transverse processes, the coccyx is peculiar in its length, being almost as long

as all the vertebræ together, and reaching to the symphysis or union of the iliac bones. Ribs are wholly wanting, a fact which bears upon his method of respiration. Like man the frog rejoices in his upper and his lower extremities, particularly his lower. He has his femur, and his humerus, his radius and ulna united in a single bone, his tibia, and fibula also united, his carpal and metacarpal, tarsal, and metatarsal bones, and phalanges for his fingers and his toes.

The muscular tissue that invests the skeleton we describe, is of whitish appearance, very firm in texture and very susceptible to galvanic action. Of its delicacy as a thing of diet, or its beauty as a thing to be studied under the microscope, we will not now speak. It is with little difficulty one can pick from the thigh of the frog muscles that are analogous to those of the thigh of man. The flexors and extensors, the recti, the glutei, the gastrocnemii are all to be found well developed, and suggest from their form, origin and insertion, a series of movements similar to those made by man. Thus in swimming, man and the frog strike out peculiarly alike. It may be noticed here in regard to his aquatic feats, that he has not the power of balancing himself and moving about at different depths of the water like a fish, but is either at the surface or closely hugging the bottom, and the same is true of him to a certain degree even in the tadpole state.

A tough membranous skin invests the body, webbing the toes of the hind feet only, green and marked with dark pigment patches on the back, and tawny or golden, colored about the throat, and full of pores that serve alike as important aids in respiration and for the secretion of the slimy mucus that keeps the body cool, glistening, supple, and difficult to hold when caught by any preying enemy. The color of this tissue is not constant, but darker, greener, brighter or more leaden-hued on some

days than others, depending doubtless on the weather and the state of the circulation. Some of the Hylæ, a species of frog inhabiting trees, possess an undoubted chameleon faculty of assuming different shades of color quite perplexing to those in search of them.

The mouth of the frog is large. The tongue springing from the lower jaw is long, bifid, and when at rest turned back upon itself. A wide esophagus leads into a single stomach capable of much distension. The small intestines are slightly convoluted and terminate in a kind of pouch or cloaca, into which also empty the ureters and ovarian and seminal ducts. The anus opens on the back. The length of the alimentary canal is three or four times that of the body. In the tadpole state it is nine or ten. In man it is between five and six. The food of frogs is insects and worms which are taken on the wing or when crawling before them by a sudden darting out of the tongue and sometimes with a leap. Like the lion, styled the king of beasts, the frog preys on no dead carcass. There must be life or motion to tempt him to strike. Like man also, styled the highest animal, he sometimes preys upon his own species. In a jar, in which I once kept some frogs, there was a rare specimen of a Hyla, a dimunitive kind of tree frog which I one day missed. Noticing an undue fullness of the stomach of one of his larger companions I performed upon him the operation of gastrotomy and delivered my Hyla, like a second Jonah, a little the worse for the gastric juice of his devourer but still living.

The lymphatic and lacteal system of the frog is highly developed. A pair of pulsating lymphatic hearts may be easily detected, one on each side of the coccyx, while another pair is found not so easily, under the posterior edge of the scapulæ. Their nervous system is also exceedingly well developed. The peculiarity attending the

course of the femoral nerve, made up as it is on each side by four filaments given off from the spinal cord at the last four vertebræ, and passing down on the outside of the ilia, permit its easy isolation, and the making of it for purposes of experimental inquiry, the sole channel of communication between the lower extremities and the trunk. The nerves of special sense, those of sight, hearing, taste, and smell, are easily traced. Sensation is more perfect about the head than the body. The eye is comparatively large, prominent and lustrous, and is beautiful to look at, or study. Its iris is not dilatable, so far as I can perceive. Besides two palpabræ, it is guarded by a semi-transparent membrana nictitans. The ear has no external orifice. A scale like membrane covers the auditory canal, like a drum-head, and communicates its vibrations to the nerve. The sense of sight is keen, that of hearing good, while those of taste and smell, from anatomical reasons, are not deemed sources of very exquisite enjoyment.

In the early tadpole portion of his life, the frog respires like a fish, by the aid of branchiæ or gills, but in the progress of his development, these, with the single heart connected with them, give place to the true lungs and the true heart, having a ventricle and two auricles. From the manner in which the circulation is thereby effected, the venous and arterial currents being mingled, aeration of the blood is but imperfectly accomplished. The frog breathes through his nose, never by his mouth. The air is drawn in by the expansion of the muscles of the throat and forced by their contraction, the nostrils being plugged as it were by the tongue on the inside, into the lungs. Expiration is effected by the muscles of the abdomen. The want of ribs in the formation of the thoracic cavity make this process of swallowing the air a necessity. The number of respirations is about eighty per minute, the aeration of the blood being as already stated greatly aided

by means of the skin. He would die as certainly if his skin were covered by viscid oil or varnish, as if his mouth were held open, and in either case it would be death by suffocation.

Behind the ear of the male frog, for they alone are provided with the apparatus, there is a membranous sac into which the air is forced as into a bladder by the action of the muscles of the throat and abdomen. On its passage inwards, not outwards over the tongue, it gives rise to the peculiar croak, or *croassement*, as the French have it, of the frog. Aristophanes, in one of his comedies, speaks of frogs as the song living race, the marshy offspring of the fountains, and tried to express the chanting of their varied watery choral music amid the noise of bursting bubbles, by the Greek words Βρεκεκεκὲξ κοὰξ κοὰξ-κοὰξ. There are three different sounds emitted by the frog, as I have noticed them, a kind of wooing, muttering on the part of the male in the spring, the regular orthodox croak, and a cry of agony or pain which I have heard him utter while being swallowed by the snake. There is a popular misapprehension in regard to these sounds, I think, which confounds the long monotonous roll of the toad, and the sharp cry of the newt, with those of the frog. It is, by no means an unpleasant thing, however, of a warm spring evening to listen to the lively music of a densely populated frog swamp. The continuous clatter of a thousand croaking throats rising and falling in intensity, accompanied perhaps by the deep bass of some lonely rana pipiens, or the plaintive cadence of the sluggish toad, or the shrill piping of the little water newt, make up, if listened to aright, a veritable concord of sweet sounds.

The first notes of the frog in spring are pleasant, through association. Like those of the robin or blue bird they are listened to as the harbingers of sunny days, and budding flowers, and a new life. It is a common saying

with farmers that after their first appearance they must be three times driven to their marshy beds by frost and ice before the reign of winter ceases and that of gentle spring begins.

With the first warm days of spring, however, in this latitude about the last of March, an upward impulse seems to bring him from "the depths where he did lie" and as the temperature of the water rises towards 60° his activity and clamor increase. The blood, long stagnant, courses with renewed activity, and desires, dormant for a twelve month, awake to a new life. The little membranous sacs we have spoken of vibrate unceasingly, pealing forth what has been called "the tocsin of copulation." A Frenchman once wrote and published a Memoir on *Les Amours des Sauriens*. A Frenchman alone is qualified to describe the loves of the frogs.

The male has no intromittent organ, and therefore impregnation occurs without actual coitus. Establishing himself on the back of the female with his arms clasped firmly in a kind of tonic spasm about her body below the scapulæ, he resigns himself for a period of from fifteen to thirty days to a seemingly passive enjoyment of his position. The impregnation of the ova takes place after they have left the female. In their passage forth they are enveloped in a gelatinous covering, which absorbing water makes an aggregate floating jelly-like mass many times the size of the body from which it emanates. It is commonly known by the name of frog spawn. Each female lays from six to twelve hundred eggs, lays them but once a year, and does not reproduce them after the third or fourth year.

The natural age to which the frog attains is not well determined. It probably reaches from six to nine years. The rana pipiens certainly lives much longer. Some specimens that I have seen had all the marks of being

ancient patriarchs. An old farmer told me that he had distinctly recognized, for over twenty years, the peculiar form and tone of one of these burly lords of the pool.

The tadpole is developed from the egg in from seven to ten days according to the warmth of the air and water. It is instructive to watch from day to day the progress of this embryonic life, and amusing at the last to see some precocious member bursting his cell wall and come wiggling forth rejoicing as a polliwog. The life of the tadpole is in all respects like the life of a fish. It breathes by gills, and feeds on minute animalculæ and vegetable growths. By aid of these, and warmth, and sunlight; and by the law of his being he approaches in from seven to ten weeks the limit of his aquatic life. Little papillæ appear on each side at the back of the neck where legs, the hind legs, of the future frog are soon to burst through. The tail grows shorter and stumpier, and he rises oftener to the surface to breathe in and out a bubble of air as if to test the veritable lungs that are to replace his primitive gills. At length the jaws, already apparent through the skin, have separated, and the mouth becomes an open fact, and then the upper legs or arms follow in the footsteps of the lower. Little by little the tail has kept decreasing, not dropping off suddenly, but absorbed atom by atom by the action of the capillary blood vessels, until at last it serves no longer as a source of locomotive pride. The change is now complete, and the young frog, a tadpole no longer, enters in a new element upon another and higher stage of existence. There is something wonderfully interesting in this change from an inferior to a superior life. Bishop Butler's analogical argument to prove the immortality of the soul drawn from the worm, the chrysalis, and the butterfly, might be strengthened here, if need be by another and no less striking illustration. Less grave, also, are the social analogies it presents of human polliwogs, whole families of them,

who may be seen wiggling along through life in the tadpole state, and whose transition to a higher grade of social being, although earnestly striven for, cannot possibly be accomplished under one or two generations.

Having spoken of frogs anatomically, physiologically, and in a measure, æsthetically, it remains for us to speak of them historically in connection with important discoveries in science to which they have contributed.

In 1770, at Bologna, Italy, in his own domestic laboratory, a tall, thoughtful-browed professor was busy testing and watching the manifestations of that mysterious agent, electricity, to the study of which the learned men of Europe, incited by the discoveries of our own Franklin, were just then giving especial attention. Perhaps to cheer his weary brain, perhaps to worry him with some trifling household topic, his wife bearing in her hand a plateful of dressed frogs' legs tarries on her way to the kitchen. The professor stops the turning of his cumbersome machine to listen, the wife sets down her plate to talk. It might have happened in a dozen ways, but the startling fact was then first remarked, that contact with the metallic conducting rod threw the frogs' legs into violent convulsions. Although as yet uncooked, they were food indeed for the professor. The germ of discovery had here its inception, and began its growth in his mind. From that day the laboratory consumed more frogs than the kitchen. After a year's patient experimenting, there was announced to the scientific world in 1791, the remarkable discovery of the electrical effect produced by the contact of animal parts with metallic substances, in a publication entitled, *Aloysii Galvani, de Viribus Electricitatis in Motu Musculari, Commentarius.*

Since that time the earth has been girdled with the name and the fame of Galvani. His discovery was the starting point for numberless experiments on frogs and metals,

until Volta, in 1800, extended it to the production of electrical effects by contact of different metals, and conceived the grand idea of what is known as Volta's pile. From this, progress in the knowledge and applications of electricity was wonderfully increased, until now we cannot estimate its influence. In chemistry, in the arts, in the spread of printed leaves, and in the transmission of thought regardless of intervening space, it has become the great agent of the world's civilization. In this very building, where this last and crowning application of the electric current to telegraphic purposes was first conceived and actually put in practice, is it not meet that we should link the glory of the achievement with the memory of the martyred frogs that gave the primitive idea birth? Could they speak from beneath the scientific altars upon which they were so freely sacrificed, might not each one exultingly croak at the recital of the fact we have stated

Quorum pars minima fui?

It is, however, in the great field of physiological researches, and in the solution of questions relative to man's organic being, that we find the frog most intimately and happily associated.

Probably one of the most important discoveries in physiology of the present century is that of Marshall Hall published in 1826, of the true spinal, or, as now called diastaltic system, or system of reflex action. It is that system of incident and reflex nerves connected with the spinal axis as a centre, and which presides over all the functions of the body, and on which depends the preservation of the individual and the continuance of the species. We breathe, we swallow, we wink the eye, we sneeze, we vomit, we excrete, emit, extrude, and do a hundred things beside by virtue of the operation of this law. It is a kind of motion or action, the first to be exhibited in the

fœtus, and the last to disappear upon death. Each function we have mentioned has its diastaltic arc as it is called, that is, a nerve furnishing the way of communication from the surface to the centre, which would be the cord and its extension the medulla oblongata and a nerve from the centre communicating to the surface. For instance, the presence of carbonic acid in the capillaries of the lung stimulates the fibres of the pneumogastric nerve, and gently says, I want more oxygen. The message travels to the centre, and the response comes back along different nerves to the muscles of the back, the intercostal muscles and the diaphragm. The cavity of the thorax widens and air rushes in. Now it is only by knowledge of the true physiology of functions that we can rightly or rationally proceed to restore them if disordered. It becomes, therefore, a practical and all important matter in the treatment of disease to know just how far we are permitted to lift the veil that hides its true locality and nature, as well as to know the true and proper direction in which to bend our efforts and address our remedies. Since the promulgation of Marshall Hall's discovery, the diagnosis of diseases has been greatly sharpened, and the practice of medicine simplified and rationalized. The law of diastaltic action is to the medical world what gravity is to the physical. If we have spoken of it at tedious length, its importance and the application we wish to make of it must be our excuse. That application is simply this: that the discovery was suggested to Dr. Hall's mind by witnessing the automatic motions of decapitated frogs and newts, and elucidated by a systematic series of experiments upon these and other animals, but especially upon frogs, by reason of the facility with which they could be procured, and the peculiar susceptibility of their nervous system.

We do not claim for frogs, that they were the instruments ushering in Harvey's great discovery of the circula-

tion of the blood, but we do say that they furnished the last fact required for the full and perfect proof of the doctrine he maintained. The actual transition of the blood from the arteries to the veins was first observed by Malpighi in the large capillaries of the web of the frog's foot.

To sit in some window above a crowded street and watch the different currents of thronging humanity beneath, is attractive to most minds, merely as an exhibition of moving life. So to sit above the little world, the microscope discloses in the transparent tissues of the frog, and watch the moving blood currents through the capillaries, even to unprofessional eyes, is strangely interesting. Now the quick throbbing arterial wave, now the sluggish venous flow, catches the eye. Now the tumbling procession of globules crowd through some larger capillary, now each individual globule glides along some narrow passage way, in single file. Now the crimson tide stops a moment, recedes, goes on, stops again like the heart beat, watched by Uncle Toby. Altogether, the spectacle is one seldom tiresome to the beholder.

Our knowledge of almost all the important facts in physiology connected with the circulation, has been obtained by the study of its phenomena as exhibited in the frog. Thus, for instance, that the capillary circulation is not controlled by the heart's action, but depends on the nutritive, and other chemical changes which the blood undergoes in its passage along the walls of the minute capillaries. Thus also was established the existence of the white corpuscles of the blood, as well as the red, and their peculiar route of travel. Indeed, in no class of animals can the corpuscular changes of the blood be better, or more readily studied, than in the frog. Again in the true appreciation of that condition of the circulation, known as congestion, and its distinction from the process called inflammation, about which as many vague things have

been written, and as many crude ideas held as any other in medicine, we are able to eliminate much of the confusion that has so long attended these terms, and prevent the mistakes by no means uncommon in the treatment of disease occasioned by this very confusion.

But we have said enough, perhaps, of these medical associations of our subject, for while there is much material remaining, showing how intimately connected have been the lives and deaths of frogs and the progress of physiological science, it would doubtless have more of professional than general interest. We pass by therefore, the many questions making up the mystery of our being, which they have helped to elucidate or solve; questions, about the workings of the nervous system, about rudimentary or embryonic life, changes of form, transitions from inferior to superior organizations, and finally questions in medical jurisprudence, even, where they have lent their mute though striking testimony in the detection of hidden crime.

If, what we have said, removes from any mind the idea of their insignificancy, or redeems them from the reproachful utilitarian inquiry sometimes made of animals lower than ourselves, of wherefore were they made, it will have answered our purpose.

In conclusion, we are, for ourselves, free to confess that we love the frogs. We love them as table delicacies, for the music they make, and for the good they have been to man. We never pass them by, when their full chorus is ringing upon the night air, with its deep bass, and airy alto mingling harmoniously, without a thrill of pleasure intensified by the recollection of their history and associations. Individually they are full of interest. They have a certain grace of form and motion, a certain beauty of color, a bright eye, and a tongue not devoid of melody. As a class they deserve respectful recognition by virtue of

the uncomplaining and unnumbered sacrifices made of them upon the shrine of science. Yes! let us all love the frogs; we will be better physiologists for it, and I doubt not, more devoutly minded. For, as Coleridge says,

> He prayeth best, who loveth best,
> All things, both great and small.
> For the dear God, who loveth us,
> He made, and loveth all.

Authorities referred to in the foregoing paper:

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Art. VI.—*Remarks on the Galvanic Battery.* By G. W. Hough, Director Dudley Observatory.[1]

[Read before the Albany Institute, November, 1868.]

The constant use of Daniell's battery for nearly ten years, made us desirous of more fully understanding the mode of its action, and the cause of the decline in the strength of the electric current. For this purpose, during the past year, a series of experiments were instituted, with batteries of various forms. As they were undertaken solely for the purpose of securing the best form of battery for every day use, delicate instruments were not provided, and consequently great precision of measurement could not be obtained.

The Galvanometer consisted of a steel needle one and a half inches in length, attached to a light strip of brass, having a radius of five inches. This needle was mounted horizontally over a coil of silk-covered copper wire. The graduation of the instrument was effected by two methods, viz : by means of the divided current, and by the revolving disk.

The Rheostat was constructed by winding No. 30 silk-covered wire, around a wooden cylinder ten inches in circumference and 8 inches in length. The coils were separated in different groups, and so connected with switches that any number could readily be introduced in the circuit.

For measuring the comparative resistance of different liquids, two small platinum plates, attached to protected wires, were fastened to a block of wood, and maintained at a uniform distance from each other.

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[1] Read Nov., 1868. Abstract read at the Chicago meeting of the American Association.

Daniell's Battery.—The battery originally constructed by Daniell consisted of a copper cylinder 6 inches high and $3\frac{1}{2}$ inches in diameter, with a porous cell or ox-gullet passing through the centre, in which was suspended a rod of zinc 6 inches in length, and $\frac{1}{2}$ inch in diameter. The porous cell passed through the bottom of the copper cylinder and the end was connected with a glass siphon, bent in such a manner that the top was on a level with the surface of the liquid. The battery was excited with a saturated solution of sulphate of copper and water acidulated with sulphuric acid. When fresh water and acid was poured in the top of the porous cell, an equal amount of liquid was forced out from the bottom through the siphon. It was intended by this arrangement to maintain at all times the same strength of acidulated water about the zinc. After this battery came in general use, porous clay cells were substituted for the membranous bag, and the siphon was discarded.

Hill's Battery.—As many of our experiments were made with Hill's modification of Daniell's battery, a description of its peculiarity is deemed necessary. This battery consists of a glass jar, with a sheet of copper placed in the bottom and a disk of zinc, perforated in the centre, suspended horizontally near the top. Protected copper wires are attached to the zinc and copper forming the two poles of the battery. When thus arranged the jar is filled with a solution of *s. z.*,[1] after which a few crystals of *s. c.* are dropped in through the orifice in the zinc, and lie on the copper plate. If the liquid is not agitated the copper will lie in a solution of *s. c.* and the zinc in a solution of *s. z.*, so long as the specific gravity of the latter is less than 36° B. The intervening liquid *s. z.* acts as a protection in the same manner as the porous cell in Daniell's battery.

[1] The following abbreviations are used: *q.* Quantity of electricity flowing in the external circuit; *s. c.* sulphate of copper; *s. z.* sulphate of zinc.

The formation of Sulphate of Zinc.—As soon as the poles of the battery are joined *s. z.* is formed in the cell containing the zinc, and metallic copper is deposited on the copper plate. A long series of experiments were instituted to determine the rate of formation of the *s. z.* during the various conditions of the battery. A Hill's element was put on a closed circuit through the galvanometer, without any external resistance, and the specific gravity of the *s. z.* was measured daily, by means of a Baumé hydrometer. The indications of the galvanometer needle and the temperature, was also ascertained at the same time. The jar containing the liquid was 7 inches high and 6 inches in diameter. The zinc and copper plates each presented a surface of 28 square inches. The distance between the plates was $5\frac{1}{2}$ inches. The battery was started with *s. z.* at 21° B. specific gravity. This element was on a closed circuit for 30 days; at the end of that time the *s. z.* was nearly saturated 43° B., temperature 50°, and *q.* had decreased to only one-seventh of its normal value. For the first 23 days, or while the specific gravity of the *s. z.* was less 40° B., *q.* was sensibly the same from day to day.

It is a fundamental principle that the formation of *s. z.* is directly proportional to the quantity of electricity passing in the circuit. This would be strictly true, provided there was no local action; but actual experience demonstrates that this condition is never fulfilled. On laying down the daily results in the form of a curve, having the specific gravity of the *s. z.* for one ordinate, and the time for the other, it was found that the observations could be well represented by an equation of the second degree in which $\Delta_1 = +1{\cdot}46°$ and $\Delta_2 = -0{\cdot}08°$. For this element, the amount of liquid saturated with *s. z.* between the limits 12° to 40° B., was 3·6 cubic inches daily. A second element of the same size in which the distance between

the plates was reduced to 4 inches, gave similar results. But the amount of liquid saturated daily was nearly twice as great, with but a small increase in the quantity of electricity generated; showing a much greater local action.

The experiments with a Daniell's element of the usual size, using a porous cell $2\frac{1}{2}$ inches in diameter and 7 inches high, gave 5·7 cubic inches for the amount of liquid saturated daily, during the normal condition of the element. As q. was nearly double that of Hill's element, and the amount of liquid saturated, less in proportion, it shows less local action. From these experiments it follows that once having determined q. the length of time the battery will maintain the current at its normal force can readily be computed; since it depends entirely on the capacity of the cell holding the sulphate of zinc. With a porous cell of the usual size, when no external resistance is introduced, the battery will begin to decrease at the end of three days and at the end of five days there will be scarcely any action. On the contrary with Hill's element, of the size before described, q. will continue uniform for more than thirty days, and will be but little less at the end of fifty days. Most of the writers on galvanism seem to imagine that sulphuric acid is essential for exciting the battery, but our experiments show that this is not the case; in fact we consider it a detriment; for if too great a quantity is used, crystals of sulphate of zinc are deposited on the zinc, thereby greatly lessening q. It seems to me that the only office of the sulphuric acid, is to make the water a better conductor; since nitric acid, muriatic acid, salt, sulphate of copper, or sulphate of zinc, will answer equally well. By using a solution of *s. z.* of a certain specific gravity, the same quantity and electro-motive force is obtained, as with sulphuric acid. This is also true for Grove's and the bi-chromate of potash battery.

The use of a number of porous cells in the same jar.—Since the decrease of q. is due to the formation of *s. z.*, the question naturally arises, how can a battery be constructed that will give a uniform current for a long period of time?

The answer is plain, we must increase the capacity of the cell in which the zinc is placed.

In a two-gallon stone jar, three porous cells were placed with a sheet of copper surrounding them. The current was then passed through the galvanometer and rheostat, and sufficient resistance inserted to make q. equal to that due to single cell, when used alone. The amount of *s. z.* formed in a given time was then measured, when it was found each cell made as much *s. z.* as if only a single one had been employed. This combination showed very great local action. Nothing, therefore, would be gained by such an arrangement, but on the contrary a much greater amount of zinc would be consumed without advantage.

We next had constructed large porous cells 6 inches in diameter and 7 inches high having a capacity of 180 cubic inches. Our previous experiments enable us to calculate with considerable precision the length of time one of these elements will maintain a maximum current of electricity. Allowing 5·7 cubic inches for the amount of liquid saturated daily between the limits 12° to 40°, it is apparent that a battery of this size should remain constant for more than 30 days, without any external resistance being introduced in the circuit. When electro-magnets are operated, as the external resistance should at least be equal to that of the battery, the current would remain constant for more than two months on a continually closed circuit.

The relation between the quantity of electricity and the specific gravity of the sulphate of zinc.—Svanberg's experiments are quoted by recent writers to prove that the electro-motive force for Daniell's battery is not materially changed by the nature of the liquid about the zinc. Although this state-

ment is strictly true, yet it does not give us correct views in regard to the battery. We prepared different solutions of *s. z.* ranging from zero to saturation. These were alternately used in the porous cell and *q.* measured by the galvanometer. The time for each experiment was about five minutes. Above the specific gravity of 15° B. *q.* was sensibly the same up to saturation. These results were so directly contrary to all our experience with the battery in actual use, that at first we were at a loss to understand them. The experiments were accordingly continued, by putting an element on a closed circuit through the galvanometer. The quantity of electricity and the specific gravity of the *s. z.* was noted from time to time. So soon as the *s. z.* approached near saturation, from 43° to 46° B. depending on the temperature, it was found that the element gradually decreased in force untill finally *q.* was less than one twentieth of its normal value. As the electro-motive force remained constant it indicated an internal resistance more than twenty times as great. But we know by direct experiment that a saturated solution of *s. z.* is a better conductor than a dilute solution, and hence we ought to expect the resistance to be less. A careful study of the phenomenon led us to conclude that the increased resistance was due to the polarization in the battery itself. When the current is passed through a voltameter or electrolyte solution, it is found a much greater resistance is introduced, than that due to the liquid alone. This increased resistance is ascribed to polarization of the electrodes in the solution and has been ably discussed by a number of scientists. But the polarization in the battery itself does not appear to have been investigated. After an element has been on a closed circuit for a long time, if the circuit be opened for a few minutes, on closing it, the galvanometer will at first indicate the maximum quantity due to the element, but in a few seconds the needle

will gradually recede and stand as before. It appears that when the specific gravity of the *s. z.* approaches saturation it becomes charged with electricity like a Leyden jar or prime conductor. From numerous experiments, we find *q.* reaches its maximum when the specific gravity of the *s. z.* is between 20° and 30° B. However, for practical purposes the battery gives essentially the same force between 15° and 38° B. Below 15° B. the conducting power of the *s. z.* is considerably less, and consequently the resistance greater, and above 38° B. the resistance is again increased by polarization. The conducting power of *s. z.* was found to be essentially the same between 30° B. and saturation. At 1° B. it was one-fourth, at 7° one-half and at 14° three-fourths as great as for a saturated solution.

On the use of the negative metal in Daniell's Battery.—The negative metal in Daniell's Battery is only useful as a conductor of the current.

For the purpose of testing the correctness of this conclusion, experiments were made with the following metals as the negative plate: 1, copper; 2, sheet lead; 3, sheet iron; 4, sheet iron tinned (the ordinary sheet tin); 5, sheet zinc; 6, cast zinc.

The *s. c.* was a saturated solution, and the *s. z.* had a specific gravity of 25° B. The quantity of electricity and the electromotive force was found to be the same for copper, lead, iron and tin. When zinc was used for both the positive and negative metal, the action was somewhat different. For two or three seconds after immersion in the *s. c.* there was a small negative current, after which the galvanometer needle was gradually deflected until it indicated a quantity of electricity nearly equal to the normal condition of the element. It then remained at rest for a few seconds after which it receded and stood at a degree indicating about one-half the quantity. The

whole time required to bring it to rest, was three minutes from the time of immersion. During the progress of the experiment the hydrogen was evolved so rapidly from the zinc immersed in the *s. c.* that the bubbles could be exploded by holding a lighted match near the surface of the liquid. As soon, however, as the galvanometer came to rest the evolution of hydrogen had nearly ceased. On removing the zinc it was found covered with a loose copper powder, not reguline metal but such as is deposited when a large battery is employed to act on a small surface. This powder did not adhere closely to the zinc, but was separated by a thin layer of *s. z.* or hydrogen. On washing the zinc and repeating the experiment precisely similar results were obtained. Although the zinc was capable of conducting the maximum quantity of electricity, yet the electro-motive force was considerably less than for the other metals. A careful examination of these experiments, leads us to the conclusion that the negative metal in Daniell's battery, only acts as a conductor of the electricity.

On the internal resistance of the battery.–In a battery with two liquids the internal resistance is made up of two elements, viz: the specific resistance of the liquid and the resistance of the porous cell. Although recent writers have remarked the variation of resistance due to different kinds of earthen cells, yet we have not learned that any one has determined separately the resistance due to the cell and that due to the liquids. By our method it is necessary to use at least two cells of different size. In these experiments three were employed.

No. 1, White clay cell 0·31 inches in thickness, 6 inches in diameter and 7 inches high.

No. 2, White clay cell 0·15 inches in thickness, 3 inches in diameter and 7 inches high.

No. 3, Split-leather cell 0·06 inches in thickness, 5 inches in diameter and 7 inches high, fitted to a bottom of inch pine.

The resistance of the element was determined for each cell separately. Then the cells were placed one inside of the other and the total resistance determined as before. After which it was found for two at a time. These several determinations gave us a series of equations, involving the resistance of each separate cell together with the specific resistance of the liquids.

The following are the results expressed in an arbitrary unit:

No. 1,	Resistance,	22
No. 2,	"	17
No. 3,	"	7.

Specific resistance of the liquids *s. c.* saturated solution, *s. z.* 25° B. 13. From which it appears that the specific resistance of the liquids is about the same as for a white clay cell of the ordinary size.

As *q.* is increased by lessening the interval resistance other things being equal, it is apparent that the leather cells are superior to those made of white clay.

On the construction of Daniell's Battery.—For a local battery, where the external resistance is small, two-gallon stone jars may be used for the vessel holding the *s. c.* solution. The negative plate is best made of sheet lead instead of copper as heretofore; as it is less expensive and is easier bent in the proper form. It is desirable to perforate the sheet with an ordinary punch, in order to secure a more free circulation of the liquid surrounding it. Ordinary sheet tin makes the cheapest negative plate, but it is unfit for general use, where the battery is required to be kept in constant action for a long period. For if the *s. c.* solution is not kept saturated, chemical action takes place between the iron and tin which soon dissolves the plates. I have, however, used it successfully. If the solution is kept saturated, in a month or so the sheet will be covered with a fine plate of copper, which may be easily

separated, provided the original plate has been properly prepared by being oiled and black-beaded before being used. The porous cell in which the zinc is placed should have a capacity of at least 150 cubic inches. As the resistance of large clay cells is more than three times as great as for those made of leather, the latter are preferred; since with the same surface of zinc *q.* is nearly doubled. The constant use of leather cells during the past year fully demonstrates their superiority over those made of white clay. For it is found in practice that for working magnets such as are used in telegraph offices for local sounders, one element as described above, gives more effective working force than two of those in ordinary use. The zinc casting may be of any form; for cells of this size, it should have an external surface of 50 square inches.

The battery should be started with *s. z.* at 15° B. specific gravity. Sulphuric acid should never be used in the cell containing the zinc. Crystals of *s. c.* are suspended in a bag or perforated cup near the top of the liquid surrounding the negative plate, in order to keep the solution at saturation. After a battery has been in constant use for a number of months, crystals of *s. c.* will be found precipitated on the bottom of the jar. When this is the case the liquid must be poured in another vessel, and all the *s. c.* removed, as it seems to lessen *q.* During cold weather the battery may be improved by adding occasionally a little sulphuric acid to the *s. c.* solution. Between 40° and 100° Fahr., the specific resistance of the liquids is increased about one-sixth for every 10° decrease of temperature. It is not desirable therefore, to work the battery at a temperature below 50° Fahr.

The zinc need not be amalgamated, but it should be cleaned once in two or three months, and all the sediment removed from the porous cell.

When the specific gravity of the *s. z.* approaches 40° B. one-half of the liquid should be removed, and fresh water added. It is always best, however, to keep the specific gravity of the *s. z.* between the limits 15° to 38° B.

If Hill's form of battery is employed, a jar of the same size may be used. With plates of 50 square inches each, placed at a distance of 5 inches from each other, *q.* is the same as for Daniell's element of the ordinary size. The negative plate may be made of sheet lead, having a protected copper wire firmly attached to it. The zinc should be cast with an opening in the centre of one and one-half inches in diameter. Iron bars for supporting it near the top of the jar, can be cast in the zinc. This battery should be started with a solution of *s. z.* having a specific gravity of 15° B. The *s. c.* is dropped in through the orifice in the zinc plate. The battery should be examined occasionally with the hydrometer, and the specific gravity of the liquid never allowed to become greater than 36° B.

Art. VII.—*Life as a Physical Phenomenon.* By George T. Stevens, M.D.

[Read before the Albany Institute May 5, 1869.]

Naturalists have recognized as the first step in the classification of those beings of which we have knowledge, three great classes or kingdoms. These kingdoms are: mineral, vegetable, animal. Within these great classes are included all objects which come within the limits of uman observation, whether visible to the unassisted eye or only revealed to vision by the aid of the most powerful glasses of the microscope; whether ponderous enough to be felt or so light and infinitely diffused that they float about in the atmosphere, a single volume of which outweighs a score of volumes of these subtle elements.

Curiously enough, the elementary constituents of beings in these three great divisions are in one sense common; that is, all the elements of vegetables are also found in the class of minerals, and the elements of animal structures are none other than those of vegetables. Indeed, certain mineral elements, under certain influences, become plants; and the tissues of plants under certain other influences, or possibly under the same influences, differently applied, assume the character of animals.

Individuals, which are extreme types of each of these classes, appear to indicate a most unmistakable line of demarkation between the classes; no one could fail to see the distinction between a quadruped and a mushroom, or between a rock and a rose; but as we descend to the lower orders of vegetable and animal existence, it is often a question requiring the nicest discrimination to determine to which of the classes a being may belong.

There are even naturalists of profound learning and research, who declare that certain beings belong to both of these two classes, and are at one period of their existence plants and at another animals. This is mentioned not with a view of endorsing the theory, but to illustrate the extreme difficulty of separating the two classes. It is scarcely less difficult to draw the line of distinction between minerals and vegetables.

Notwithstanding the striking peculiarities pertaining to each of the kingdoms, when we reach beings sufficiently developed to represent to any certain degree the class to which they belong, there are very many characteristics which are common beside the material which enters into their composition.

The first common characteristic which we observe, aside from material, is a tendency on the part of the ultimate particles or molecules of each of the classes to arrange themselves in certain definite, specific forms; and if the circumstances surrounding any being be favorable, it will invariably assume the form peculiar to its class.

Any variation from this law is the result of opposing influences which the molecules cannot overcome. And as here is one of the first fundamental structural laws common to all beings, so here we observe the first indication of a line of distinction upon which any classification can be founded.

In minerals, where a specific form is assumed, the molecules unite in crystals, they are usually bounded by straight lines and angles, while vegetable and animal structures are built of cells; the prevailing idea is a sphere, and the parts are bounded by curved lines and surfaces.

Here, it would seem, that there is an absolute line of separation were it not for some exceptions which we may have occasion to mention.

If there is not an absolute line of classification in the general outline of minerals, as compared with plants and animals, we have but to advance one step and we find what seems to be a remarkable and invariable difference.

Plants and animals are always built up from cells, minerals, never.

Here then is our first absolute line of departure from a common type in the construction of beings, and it may be regarded as extremely doubtful whether we find another. Between plants and animals, it is doubtful whether there is more than the single distinction, a plant deoxydizes, an animal oxydizes.

Beings of neither of these classes are, where the typical form exists, formed by simple accumulation of particles. The assumption in most physiological works that minerals are built by simple accretion of particles is not true; but there is a process, wonderful in its perfection, by which certain particles, under certain circumstances, are arranged in the form of a crystal, and certain other particles, under certain other circumstances are made to constitute a cell. That the cell differs widely from the crystal all must admit; but that there is less perfection in the arrangement of the particles of the crystal than of the cell has never been demonstrated.

That peculiar formative process by which particles or molecules are arranged into cells has received various names, which are perhaps well enough in themselves but they have been so long used in a vague and undefined manner that the idea conveyed is often, if not generally, erroneous.

The phenomena which distinguish plants and animals from minerals are called collectively, *life*, or the vital process — vitality—by which terms is usually understood far more than seems to be indicated by the actual processes. Physiologists, recognizing the difficulties attending the use

of words which seem to imply so much that is unknown and so little that is known, have substituted the word *organization* as the dividing characteristic between the first and the other two classes. Possibly this might convey a more definite idea if it could be assumed that there is no such thing as organization in minerals.

As I believe that it can be shown that the process of arranging the molecules of a crystal is as truly a process of organization as the arrangement of the molecules of a cell, and inasmuch as the terms *organization, formative process* should indicate generally and not specially, the process by which beings are formed, it would seem that there is little of definite meaning to the terms as used, and that so far as any idea is conveyed it is essentially erroneous.

If it is true that crystallization is really organization, it follows that we have two forms or varieties to study, the one working silently among minerals, the other building up the wonderful structures which we call living beings. Except in this cell form of organization there is no animation. Without this peculiar process, the earth would be a cheerless desert. There would be no longer green hillsides with flocks and herds; forests and groves, fields of waving grain and gardens of flowers would disappear; the singing of birds and the voices of childhood and youth would be hushed, and the gloomy earth would become a realm of desolation and death.

What is this process that builds the tree and paints the flower; that forms the beast that grazes upon the hillsides, and the bird that wings its way through the air; that gives the brilliancy to the eye and the bloom to the cheek?

It is impossible to begin the study of the laws which divide and unite the three great kingdoms in beings of complex nature; for so curiously and so mysteriously are the forces brought to bear, that we are confounded and

overwhelmed by the surprising manifestations that meet us at the very outset of our investigations.

He who would learn to read does not begin at once to discuss and analyze the literary beauties of Milton or Shakespeare, but he learns first the simplest symbols and combinations. So when we would learn to read from the book of nature the secrets of *life* we are not to commence, as many do, with the most complex forms of existence; but we are first to learn what we can from the simplest forms, and trace the processes we find higher and higher as we become more and more familiar with the elements of truth they teach us.

The simplest living structure is a single cell. Some plants and some animals are composed of just this one cell. Now what can we learn from one of these minims of creation?

We find the green scum that floats on a stagnant pool, we place a little of it under a powerful glass, and we see that the scum is made up of hundreds of individual plants, each plant a single cell.

How does it look under the glass? It looks like a bag containing a transparent sac, within which is a fluid, and in the centre a dot; around the dot are many minute points or smaller dots arranged like a system of planets about a central globe.

Every one of these little plants of this simple construction consists of this outer bag, this inner sac, this contained fluid, and the dot. These cells or individual plants are very minute; a hundred of them would rest upon a pin's head.

Here then under the glass of the microscope we have a living being in which we can inspect each of its parts, and see all its little plans of life. Are these plans in any way similar to the operations in higher structures? Yes; what transpires within the limits of this little sphere is a type of all the operations carried on in every tissue in every living creature?

Indeed, at one period of its existence, every living thing, from the lowest plant to the highest animal, to man himself, was nothing more then one of these little spheres; and the most complex being can be traced back to its condition as a sac with its contained fluid and dot.

The higher forms of existence are made up by the multiplication in numbers and modification in form of these same cells; and life in man himself is but the multiplication of what may be seen in this little cell under the glass.

Now let us see what goes on in the little being. If it continues to live under the glass we shall presently see that the minute granules, which are within the cell, are moving about. Watch them closely, and we find that they are all revolving about the nucleus or dot. We may observe what seems at first some confusion, for while the granules seem nearly all to be revolving in the same direction some very small ones seem to have an irregular motion; but by closer inspection we see that these smallest granules are revolving like satellites about other granules, which are larger and which have entered upon a stage of their existence hereafter to be described.

I shall now crave your indulgence for a moment while I call your attention to what seems to me at least a very curious analogy. I would like to leave the little cell with its revolving granules, and exchange the microscope for the telescope. If on some bright evening we go to yonder observatory, and watch the eye-piece of the telescope as the instrument is made to point to the stars, we shall gaze upon objects of wondrous interest. Jupiter and his satellites, Saturn with his moons and rings, and other planets are brought to view with greatly magnified splendor. As the instrument sweeps from one point of the heavens to another it brings to our notice a hazy, cloudy mass larger than hundreds of stars, looking in the distant heavens like

an illuminated mist or as though some comet in its rapid flight had left a portion of its train behind. Such luminous masses are always found in the same part of the heavens, as fixed as are the fixed stars themselves. Astronomers call them nebula.

There is a theory now accepted by astronomers that our solar system was formed from just such a nebulous mass. Let me recall very briefly the main points of this theory.

The nebula of which our system was formed was set in motion by the power of omnipotence, and made to revolve. By its swift motion and by the attraction of particles for each other a central globe was drawn together, leaving the nebula divided into this central sphere, and a great ring of nebulous matter revolving about it. This central mass is the sun. At length the great ring, by the velocity of its motion, was broken into lesser rings, one within the other, all revolving in the same direction. The force of attraction and the swift revolution of the rings caused them again to break up, but not as before. Now instead of dividing into thinner rings the matter gathers into globular masses, and these masses revolve upon themselves while they continue to fly in the great orbit originally occupied by three several rings.

Here, then, we have a great central globe, around which was a ring of nebulous matter, which ring has broken up into smaller globes which revolve about the central one; and all these are surrounded by and contained in an atmosphere or ether, which, while it may be unlike our own, is still a surrounding and enveloping element for them all.

Now do we see between this system of globes and this little cell with its nucleus and revolving granules any resemblance? Is there not at least a very strong suggestion: that a single thought prevailed in the creation of the microscopic plant and the almost infinite system of worlds? And when we remember that this same principle of the

cell reaches through all phases of living existence (as I shall presently show it does) does not the suggestion become a conviction that a single mind has designed and created them all; and that they are all, solar systems and living beings, designed on the same plan — different manifestations of the same grand idea, a single law governing them all?

The little granules contained within the cell walls at length enlarge. They appropriate the nourishment in the little sac of fluid, and the sac in turn continues to draw more from the surrounding medium. The little granule is seen to collect about itself a thin transparent ring of matter which becomes an envelope like the original sac, and we are reminded of Saturn and his rings. Here, in one part of the field of the microscope is the miniature Saturn. There is another granule growing rapidly, around which other smaller granules revolve, reminding us of Jupiter and his moons. In another part of the field a little group of granules revolve together, recalling to mind some constellation, while the clear liquid in which this little cosmos is contained is like the celestial spaces. We cannot watch the process under the microscope without the conviction that the little plant is a repetition, on a small scale, of the systems of stars about us.

It may be said that the existence of cell walls destroys the analogy. That in one case we have but the circulation of a fluid within a closed cavity, while in the other we have the revolution of great masses in open spaces. But the cell wall is not essential, for these revolutions of granules may be seen in masses of protoplasm in which there is no indication of a cell wall, the granules are gathered about the nucleus and independently of any boundary but the attraction by which they are related to the nucleus, perform their revolution. Thus the analogy becomes perfect, the cell wall is an addition to the ideal cell, placed about it by

infinite wisdom to protect the little system, and to assist in its relations with surrounding systems. Divesting the cell of its investments, and there remains but the difference in magnitude between the galaxy of the planets and the group of microscopic granules.

As the sac of the cell continues to draw within itself materials for protoplasm, and as the granules increase in size, they become too large to be contained in the parent cell, which bursts, and we see that each larger granule has become a new nucleus, has surrounded itself with cell walls like its parent, and is prepared for a separate existence. Each of the new cells is seen to teem with new granules; and each, as these granules enlarge, bursts and gives rise to a new brood of living beings.

Particles have been drawn from the mineral world, carbonic acid, water, and ammonia, have been taken up and decomposed, and certain quantities of oxygen returned to the atmosphere. Thus far, the process is purely chemical. But these materials are no longer carbonic acid, water, and ammonia. Each of these minims of the vegetable world has not only imbibed from the mineral kingdom certain elements, but it has assimilated this pabulum, converting it into products for its own enlargement or growth, and for the nourishment of still another class of beings. The elements which have been used in this process have taken a form never known to them in any other relations than when combined in living structures, and instead of remaining amorphous or assuming a crystalline form are arranged in cells. Whether the force which causes these particles when thus brought together in these proportions and under these peculiar circumstances is an inherent property of matter and corelated to the other forces which are manifested in the mineral world, or whether it is a new and peculiar force superadded to beings of this construction, and which is called *vitality*, is a question which we will ex-

amine when we have briefly considered how these units of living structures are related and combined in higher organisms.

We have seen the life process in the most simple structure, let us trace its workings in more complex beings. Cells do not always retain their spherical form, even when they are originally spheres. One of the first modifications is an elongation in the direction of growth.

Let us now advance one step in the process of existence.

Here I represent a being, a plant consisting of several such cells as have been described, and as we see, they are elongated in the axis of growth. The cells are connected at the extremities, and are thus united to make up a single individual. Now the little green filaments which we have all seen floating on the still waters, are, many of them, made up just in this way — a single row of cells, connected at the extremities.

Let us examine another form. Here is a filament made up of a single row of cells, but instead of being elongated they are flattened. This is the appearance of certain sea-weeds when placed under the lenses of the microscope.

Now, let us take a very small thread of muscular fibre, and place it in the field of the microscope. It will present the appearance of several of these little threads of sea-weed placed side by side, and if we separate these rows of cells and place a single ultimate fibre of muscle under the glass, it may be hard to tell which is the fibre of muscle and which the thread of sea-weed. Thus we see that a very large and important portion of the human body is built on the identical plan of the structure of the humble weed. And do we not see also how rapidly we have advanced in the scale of being? We commenced with the simplest living structure, the slime in the pool, then we examined a being scarcely higher in the scale of life, and then by the most natural and easy advance came directly

upon the principal tissue of man himself. Thus far we have spoken only of cells that retain very nearly the typical, spherical forms; but many cells are so modified that a casual examination detects no relation to the type. The cell is modified in form according to the purpose it is to serve in the economy of the individual. In the fibre of the linden or oak it is long and flexible, more like a thread than what we have figured as a cell. In what are called fibrous tissues too in the bodies of animals it is often drawn out in the form of a long cylinder. Perhaps we may be able to trace the transition from the round cell to the cylindrical one so that we may keep the relationship in view.

Let us make a hollow sphere of india-rubber in imitation of a round cell, the rubber taking the place of cellulose. Let the sphere be large enough to illustrate the changes we desire to witness and the walls thin enough to be transparent. In the centre is a fluid, and within it some elastic substance which may represent the dot. Now let us fasten two fine hooks, one to one side and one to the other of our elastic, transparent sphere. Draw upon the hooks and do we not see that the rounded body becomes pointed? Draw a little more, it is fusiform; still more, it is like a fibre, and now we can only see it as a tube. The first, or rounded form is found in blood corpuscles in our own vessels, and discs of essentially the same structure are also found in the mucous membrane lining the mouth, in the skin and in other tissues of the body, and we have already seen how slight is its modification in muscular fibre. The other forms are found in fibrous tissues. The long tubular form is common in woody fibres. The fibre of cotton is an example of a cell greatly extended.

It might be shown, had we the time and were it necessary, that every part of a plant or an animal is built of cells, but the proposition that such is the case will doubtless be accepted by all.

As I have already intimated, the cells draw from the surrounding fluids the materials necessary for their growth, and it is a remarkable fact that every kind of cell has the power, or faculty, of selecting and appropriating just such materials as are needful for its own peculiar structure. This faculty is, however, confined within certain limits. Thus the cells of plants will absorb carbonic acid, water, and ammonia, and unite these elements in the form of cellulose, but to the animal these materials would furnish only starvation diet. But these same compounds, carbonic acid water and ammonia, when once united in the plant, become food for the animal.

Having traced the history of the cell and its relations to living structures, thus far, it requires no stretch of imagination to perceive clearly that all living forms are fundamentally alike, and that the cell or more exactly the protoplasm, from which the cell is built, is the real basis of all life. It is also easy to show that the movements of living beings are the result of changes of form in these structural units. Thus muscular contractility, which is regarded as one of the crowning marks of distinction between animals and all other classes of beings, results, simply from the flattening or shortening of multitudes of individual cells, and this effect may be produced by the action of electricity as well as by the force which passes along the line of a nerve, and this phenomenon of contractility is, by no means, confined to animals, but is found also in plants, and it might be shown that the identical principle exists also in minerals. But aside from this last statement, it is evident from what we have already seen, that the difference in faculty between the lowest plant or the lowest animal and the highest of its class is but one of degree, and not of kind. There would seem to be the widest contrast between the simple being we have figured as the unit of the vegetable world, and the giant tree that

withstands the storms of ages, or between the deer that flies over the plains with fleetness and grace, and one of the microscopic inhabitants of a drop of water.

But as we trace the faculties of each to its origin we find that the contrast consists in the fact that in the lowest organisms each part is capable of performing all the functions of the being while in the higher structures the functions are distributed to different organs. This is an apparent rather than a real distinction, and hence it follows from this and from all that we have seen of the plan of living beings, that so far as the essentials of life are concerned we may regard the microscopic plant as a representative living structure; and in this light let us compare it with other beings which are not usually regarded as organized, and let us, if we are able, see where the process of organization begins, and when it becomes necessary to call to the aid of the ordinary forces and properties of matter, that peculiar and mysterious something called vitality.

Let us inquire whether we shall accept the theory that an all-wise architect has brought together the molecules of a cell, placing them in definite positions and arranging them for a specific purpose, while the atoms of a crystal have fallen together by chance and are the result, not of growth but of aggregation.

Certain elements unite to form protoplasm. They are carbon, hydrogen, oxygen and nitrogen, but these elements refuse to combine directly to form this protoplasm demanding first a binary union among themeselves. Carbon and oxygen unite as carbonic acid, hydrogen and oxygen as water, and nitrogen and hydrogen as ammonia.

By the action of light, heat and electricity, which are but names for certain vibratory motions of matter, these compound molecules are made to move upon each other in such a way that protoplasm, a substance more complex in its chemical composition than mineral structures, and

at certain ranges of temperature more unstable than some of them, is formed.

On the other hand, from a solution containing oxide of calcium and carbonic acid two binaries instead of three, a selection of atoms takes place. The liquid solvent with all the substances it contains, other than the two we have mentioned, are rejected, while the compound atoms of lime and carbonic acid, are united as a solid body having greater perfection of outline than the cell, and equal chemical purity. Here we have a crystal of calcareous spar; there we have a cryptogamous plant; the one is made of calcium, carbon, and oxygen, the other of carbon, hydrogen oxygen, and nitrogen. Neither of these groups of elements combine spontaneously under any and all circumstances. Pass a current of carbonic acid over a quantity of quick lime and you have not a crystal. Mingle carbonic acid, water, and ammonia, and you have not a plant. Around the plant are certain elements in solution which by a continual process of selection are assimilated to itself. Neither the animal nor the crystal differ from it in this respect.

The undulations of light, of heat, or of electricity, singly or in unison, cause these compound atoms to oscillate in harmony with the moving force, and as the particles are thus agitated by this tremulous molecular motion, the crystal or the cell result according to the nature of the ultimate particles interacting upon each other; and it is more than probable that could we but measure the waves that move the atoms, and weigh the molecules which enter into the structures, we might mathematically deduce the cell or the crystal from the materials and the force.

In considering the relations of minerals with plants and animals, we may perhaps soonest arrive at the real nature of these relations by examining some of the reasons almost universally accepted for regarding these classes as having no relations at all.

The principal features which distinguish what are called organic from inorganic bodies are thus given by one of the latest as well as one of the best and most complete works on physiology :[1]

1st. Minerals grow by accretion, plants and animals by living processes.

2d. The form of organic bodies is determinate; but a determinate form is not essential to minerals.

3d. In size organic bodies are determinate, while minerals deviate from any given standard of bulk.

4th. They differ in chemical composition.

5th. They differ in structure.

6th. Minerals are more permanent than organic structures.

7th. Organic bodies are all derived from parents.

Here, then, we have the full array of causes for *vitality*, and our author comments at length upon each of these distinguishing characteristics.

But will they stand the test of a rigid examination, so far as establishing the necessity of a new force is concerned?

"Minerals" are said "to grow by accretion, plants and animals by living processes."

Let us examine a living structure, and see whether it has any comment upon this proposition.

There exist in more or less abundance in most plants, crystals which often occupy the centre of a cell. In the tissues at the base of an onion may be found myriads of the most beautiful crystals. Here we have a compound crystal, in the form of a Greek cross, perfect in its symmetrical beauty, with its angles and planes more exact than could have been formed by the most skillful human mechanism, composed of four prisms grouped in such geometri-

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[1] *Marshall.*

cal perfection as to excel the most complete work of art. Are we to be told that this exquisite gem, found within the walls of this cell, results solely from accretion of matter, while the envelope in which it is contained is the result of organization or of vitality?

But the "form of organic bodies is determinate, while a determinate form in minerals is not essential."

Properly viewed this is an absurd proposition. Matter has two determinate methods of uniting; in the form of the crystal, and in the form of the cell. We might with equal propriety select out the crystals, and say that because the remainder of matter is not invariably arranged in cells, therefore a determinate form is not essential to living structures.

It is also said that organic bodies are determinate in size, and that minerals are not. Are not the diamond, the calc-spar, the emerald and the garnet as determinate in size as the pine, the oak, or the cedar?

"They differ in chemical composition. The compound chemical substances contained in or derived from organic bodies are not imitated in the laboratory of the chemist, and must result from some force not known to ordinary chemistry."

This might have been a plausible proposition before Wöhler produced the organic compound urea, from inorganic elements in the laboratory or before tartaric acid, oxalic acid and other vital compounds were made without the intervention of any vital process.

"They differ in structure." "Organic bodies are composed of different parts having specific relations to each other. They are also heterogeneous as compared with the homogeneous structures of inorganic bodies, and from this heterogeneous structure arises the tendency and necessity during the life of an organized body of undergoing cease-

less internal motions and constant changes, while minerals may remain unchanged for an indefinite period of time."

Of course it is admitted that the structure of a plant differs from the structure of a mineral. It seems to be a fixed law of nature that when the compound atoms of water, ammonia, and carbonic acid, are subjected to certain influences, are agitated by certain ethereal waves, these atoms assume a certain form; while the simple atoms of oxygen and hydrogen, agitated by the waves of an electric current, assume a different form. The product of the four elements may be a sea-weed; the product of the two, a snow flake. This transformation by certain ethereal undulations into molecular rearrangements, which are unlike, demands for its explanation no new force.

We can hardly be required to explain the ceaseless changes, which are observed in living structures by any new force if they can be produced from forces already known to exist. It is a well established rule in science to eliminate unknown quantities from the problem when known quantities can supply their places as elements of the problem. Protoplasm is but the arrangement of certain atoms which are peculiarly subject to molecular change, and this may be said of all nitrogenous compounds.

The decomposition of substances containing nitrogen often evolve a sudden and surprising evolution of force. Witness the explosion of gunpowder when once its atoms are relieved from their unstable relationship by the vibratory action of heat. Mineral substances are only stable within certain limits.

The snow flake which falls upon your hand, a crystal of almost unparalleled beauty, is instantly resolved into an amorphous condition, and from this it is presently transformed into thin vapor. Can permanency of structure be claimed as a barrier to the relations of minerals and plants?

It may be said that the sudden destruction of the snow flake, or the more startling decomposition of gunpowder are unlike the ceaseless transformations which from hour to hour and from year to year may be observed in a living being of the higher orders. The cases are however alike, and the fact that one is an instantaneous change while the other is a succession of changes does not destroy the analogy.

But are there no gradual decompositions in the mineral world that correspond not only in the result but in time with those of living structures?

These ceaseless internal changes are the manifestations of an evolution of force, and force is never evolved without change in the relations of particles. Every contraction of a muscle, every exercise of the mind implies evolution of force with corresponding destruction of living tissue; that is, a breaking up of the relations of atoms with each other and resolving live matter back to its mineral elements. If much force is evolved much organized matter is resolved, and all the varied manifestations of life depend on the amount of force.

The laborer who employs muscular force requires a large amount of material to replace the tissues broken down in maintaining the necessary movements. The student who labors severely with his brain may find on the following morning that phosphates in large quantity are eliminated.

Let us turn to the mineral world, and see if similar internal changes accompany the evolution of force.

Let us pour into a cup a solution of sulphate of copper; place in the cup also a strip of zinc and one of copper. The solution will remain for an indefinite time unchanged. But connect these strips by means of a wire, at once force is evolved, and we call that force electricity; and just in proportion to the evolution of this force is the de-

composition of the solution. Now is it not plain that these ceaseless internal changes in living beings in no way differ from those observed in minerals and that they are the necessary physical results of evolution of force? And were it necessary to illustrate this point further we might refer to seeds which after remaining buried beyond the disturbing influences which cause germination, for hundreds of years, have, when brought to the surface, sprouted and grown as readily as those which ripened but the autumn before. If a seed may remain alive for a thousand years with no internal changes why may it not for six thousand? If it is not subjected to certain forces which disturb the relations of its particles it may be as permanent as the granite hills.

So the solution of copper, so long as the disturbing element is not introduced, is a permanent solution; but once stretch the wire between the plates and let force be evolved, and the destruction of the solution has commenced.

There remains but the difference of origin. Why it is that protoplasm is not organized except by the aid of a nucleus of like nature we know not. But there are very many things in nature of which we can give no account. Are we assisted by bringing a name to our rescue, and saying that it is *vitality?* This method of resolving hard problems in science has been too long in fashion, and should be discarded.

Why not frankly confess that we have not found out the mystery of generation, and if it is worth finding out apply ourselves to the solution of the mystery and not cover it with a name which is but a dream of the imagination and carries with it not the shadow of any scientific intrinsic value?

For my own part I see no manifestations in living organisms which are not better explained by calling them the properties of matter than by calling them the result of *vitality;* and we have never been able to explain any phenomenon in which the ordinary, recognized forces of nature have not been our only aids.

Why then satisfy ourselves with mythical and mystical words which shall deceive us with an appearance of wisdom, but whose only office must be to point us away from the true path of investigation?

ART. VIII.—*On the Velocity of the Electric Current over Telegraph Wire.*[1] By Prof. G. W. HOUGH, A. M., Director of the Dudley Observatory.

[Read before the Albany Institute, June, 1869.]

The velocity of the electric current over land lines of telegraph has been the subject of numerous experiments during the past twenty years. The great discrepancies existing between the different determinations, led us to suspect that the so-called velocities were mixed up with some other phenomena; since they were found to vary between 13,000 and 30,000 miles per second.

My attention was especially called to the subject by Mr. C. S. Jones, manager of the Albany W. U. Office. He expressed a desire to undertake some experiments for velocity determinations, which were finally begun in April last.

Whatever value may attach to these results, Mr. Jones is entitled to an equal share of credit; since without his assistance and cooperation it would have been impossible to make them. We would also express our thanks to the officers of the W. U. Telegraph Co., for the use of the necessary wires, batteries, etc. We might here state, that the company have on other occasions shown great liberality in furnishing us wires, for the use of scientific investigations.

The following table will exhibit the principal results heretofore deduced for the velocity of the electric current:

[1] Abstract read at the Salem meeting of the American Association.

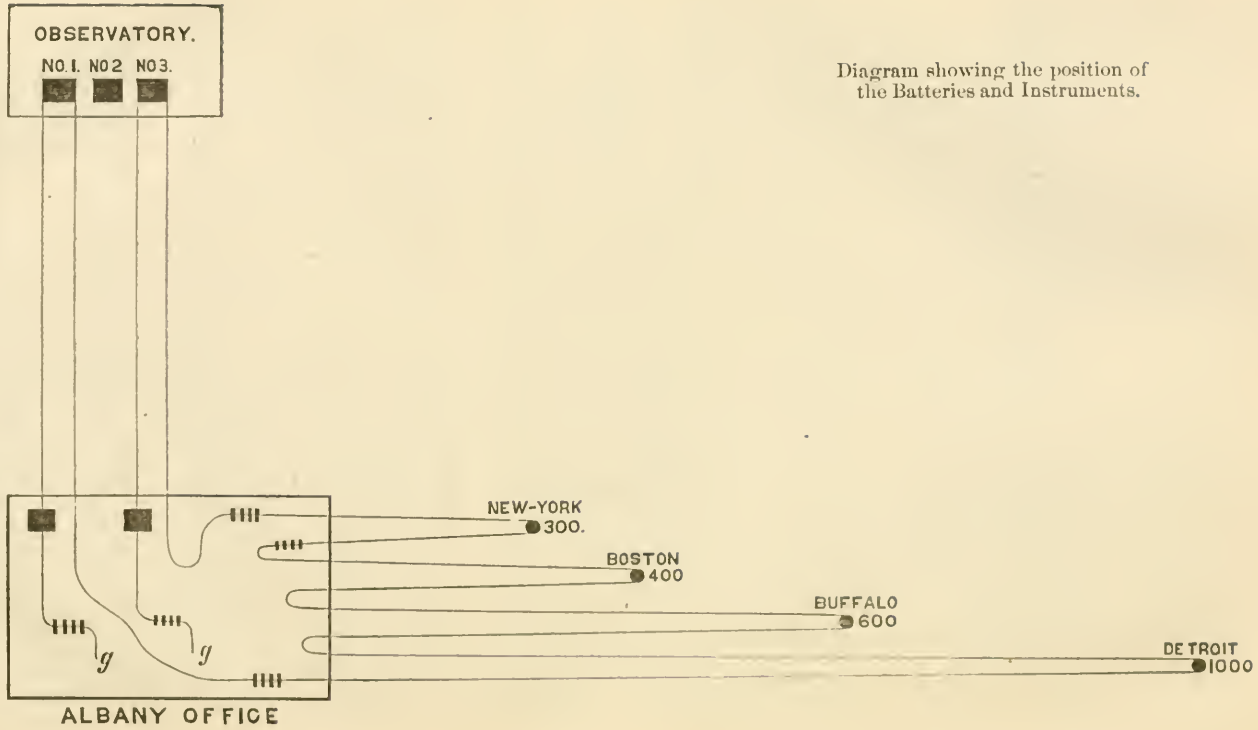


Diagram showing the position of the Batteries and Instruments.

Date.	Length of Circuit.	Velocity per second.	Observer.	Remarks.
1833–4,	⅛ mile	288,000	Wheatstone	Leyden Jar
Jan., 1849,	880	18,700	Walker	Relay
Oct. 31st, 1849,	590	16,000	" "	"
Nov., 1849,	607	28,500	Mitchel	"
1850,	260 Iron	60,000	Fizeau & Gounelle	Galv. Needle
1850,	130 Copper	114,000	" " "	" "
1850.	1045	15,000	Gould	Relay
1850,	447	17,000	Walker	"
1850,	230	13,000	" "	Chemical Telegraph
1854,	104 Iron	115,000	Guillemain & Burnouf	Diff. Galv.

An examination of this table reveals no law, except that apparently the shorter the circuit and the more delicate the instrument, the greater is the velocity.

Circuits were secured on the nights of April 8th, May 20th and May 27th. But owing to want of uniformity in the adjustments and manipulations of the instruments, only those results, obtained on the 27th, can be employed for determining the law of propagation.

Relays.

Three different relays were used in these experiments the approximate resistances of which. are as follows:

No. 1,	30	miles	of	No.	9	wire,	Tillotson,	maker.
" 2,	55	"	"	"	"	"	Day,	"
" 3,	35	"	"	"	"	"	Williams,	"

Nos. 1 and 3 were placed at the ends of the circuit. No. 2 could be switched in either end at pleasure, or cut out entirely.

Switch Board.

A special switch board was constructed which was capable of the following manipulations:

1. Relay No. 2 could be thrown in either end of the circuit.
2. Relay No. 2 could be thrown out entirely.

3. The clock could be made to open and close the circuit, at either end of the line.
4. Each relay could record the clock beats on the chronograph.
5. Each relay could work a local sounder.

For accomplishing these changes, ten movable switches were necessary.

Chronograph.

The chronograph used in these experiments is a revolving disk, provided with two recording pens, worked on an open circuit. It is capable of recording time to the one-thousandth part of a second, and has been fully described in vol. I, *Annals of Dudley Observatory*.

The local circuit passing through the sidereal clock, included chronograph pen, No. 1, together with a small pony sounder, arranged to close the main line circuit in the same manner as an ordinary relay. When the clock was thrown in circuit its beats were recorded on the chronograph, by pen No. 1. As the sounder worked simultaneously with the chronograph pen, the main circuit would necessarily be opened and closed at the same instant, and the relays would be operated. If then the necessary connections were made, the relay would record the clock beats on the chronograph with pen No. 2. Now in case the length of the main line was only a few miles, and the armature time of the magnets zero, the two chronograph pens would record the clock beats simultaneously. This condition can be secured, by increasing the armature time of pen No. 1, so that it shall equal the sum of the armature times of the pony sounder, relay, and pen No. 2. We have, however, thought it preferable to reduce all the armature times to a *minimum*, and determine it for each separate magnet.

Armature Time.

The armature time depends on the following conditions:

1. Strength of Battery.
2. Tension of Spring.
3. Distance of Armature.
4. Motion of Armature.
5. Permanent Magnetism.

In order to eliminate as much as possible the source of error arising from variations of armature time, 2, 3, and 4, are reduced to a minimum. More especially is this necessary for (4), the motion of the armature. In our final experiments, the play of relay armature was reduced to one or two-thousandths of an inch.

When (5) is zero (which is the case with a local circuit or short line), and (2), (3) and (4)' are reduced to a minimum, the strength of the battery does not essentially change the armature time.

In working over a long line of telegraph wire, the escape is always considerable; consequently, in order to work from both ends of the circuit without change of adjustment, 3 cannot be reduced to a minimum, but will depend on the amount of escape, and the strength of the battery.

In our experiments, the armature time of relay, plus recording pen No. 2, was determined for each separate adjustment.

Circuits.

The circuits were made up by Mr. C. S. Jones manager of the Albany office by looping together wires leading to Buffalo, N. Y., Boston, etc., until a sufficient length of circuit was secured. The connections at those points were

made by the managers or operators in charge. I cannot but express my thanks to them for the courtesies and facilities afforded us in these experiments.

When all the arrangements were completed for the experiments, the operator at the Observatory requested a certain length of circuit with a given number of battery elements. As soon as the necessary connections were made, Mr. Jones stated the length of circuit; together with the number and position of the Battery elements. The clock was then thrown in circuit and the line was opened and closed at one end, and each one of the three relays were used to record the beats on the chronograph. The same thing was also done by opening and closing at the other end.

Each complete experiment gave the following results:

1st. Armature time of relays.
2d. Armature time, plus time of transmission.
3d. Armature time, plus time of transmission in the opposite direction.

For the second experiment, additional length of circuit was secured and the same class of results deduced.

In this manner, the longest circuit was used which the batteries and instruments were capable of operating.

The circuits were continuous, without any repeater or relays, except those used at the Albany office and the Observatory.

As the repeater time varies from 0.^{s}03, to more than 0.^{s}10, any results for velocity through them would be greatly impaired, if not entirely vitiated.

The longest circuit employed, was 2,400 miles. Intelligible signals and clock beats could be sent over it, but owing to trouble on the wire, we were unable to use the results for velocity determinations.

Each separate result was the means of at least twenty-five measures, from the chronograph sheets.

The following table exhibits the final results:

Observed velocity miles per second.	No. of Battery elements.	Length of circuit in miles.	Remarks.
		April 8th.	
12,200	120	1,000	Not comparable, owing to the change of adjustment between the experiments.
14,400	165	1,000	
		May 20th.	
6,700	205	1,300	Not comparable. Trouble on the line. Tension of spring adjusted very taut.
9,300	250	1,300	
12,400	295	1,300	
		May 27th.	
10,200	70	400	Adjustment of relays not changed.
20,000	160	400	
29,450	295	400	
18,200	295	1,000	

An inspection of these results show at a glance, that the velocity increases with the number of battery elements employed; also for the same battery it decreases with the length of the circuit. The question then generally arises, can the apparent velocity be expressed by a rigid mathematical formulæ?

The great difference between the velocities obtained on different nights, as also on the same night, leads us to inquire whether this is a real velocity of the electric impulse, or only a mechanical phenomenon manifested in the electro-magnet.

If the celerity of the motion of the armature, is proportional to *magnitude* of the force acting on it, then, our apparent velocities ought to be directly proportional to the *magnetic force* of the current. If this is found to be the case our results can only be regarded as mechanical effects, entirely distinct from the real velocity of the electric wave.

Ohm's celebrated law enables us to compute the magnetic forces for circuits of all kinds, and from these, to deduce the relative ratios of the velocities.

The general formulæ is

$$f = \frac{n\,e}{n\,\mathrm{R} + r}.$$

f = Magnetic force of the current.
e = Electro-motive force.
n = Number of battery elements.
R = Resistance of one battery element.
r = All the other resistances in the circuit.

This formulæ will be somewhat modified by the escape, but as the amount was not measured, the computation will be made without taking it into account.

If we make the resistance of the relays equal to 200 miles of line wire (which cannot be more than $\frac{1}{10}$ in error,) and will not materially affect the computation, we will have the following equations, for the expression of the magnetic force, for the four experiments of May 27th.

$$f_1 = \frac{70\,e}{70\,\mathrm{R} + 400 + 200} = \frac{70\,e}{70\,\mathrm{R} + 600}$$

$$f_2 = \frac{160\,e}{160\,\mathrm{R} + 400 + 200} = \frac{160\,e}{160\,\mathrm{R} + 600}$$

$$f_3 = \frac{295\,e}{295\,\mathrm{R} + 400 + 200} = \frac{295\,e}{295\,\mathrm{R} + 600}$$

$$f_4 = \frac{295\,e}{295\,\mathrm{R} + 1000 + 200} = \frac{295\,e}{295\,\mathrm{R} + 1200.}$$

The ratio of the velocities observed, making the first unity, is as follows:

$$V_1 = 1$$
$$V_2 = 1.97$$
$$V_3 = 2.89$$
$$V_4 = 1.79$$

Substituting these values of V_1, V_2, &c., for f_1, f_2, &c, in the four equations and determining e & R we find,

$$e = 10.05$$
$$R = +1.43$$

Now with the computed values of f_1, f_2, &c, we may compute the apparent velocities. The following is the result:

Observed Velocity.	Computed Velocity.	Diff. o—c.	Length of Circuit.	No. of Elements.
10,200	10,200	+000	400	70
20,000	19,700	+300	400	160
29,450	29,580	—130	400	295
18.200	18,560	—360	1000	295

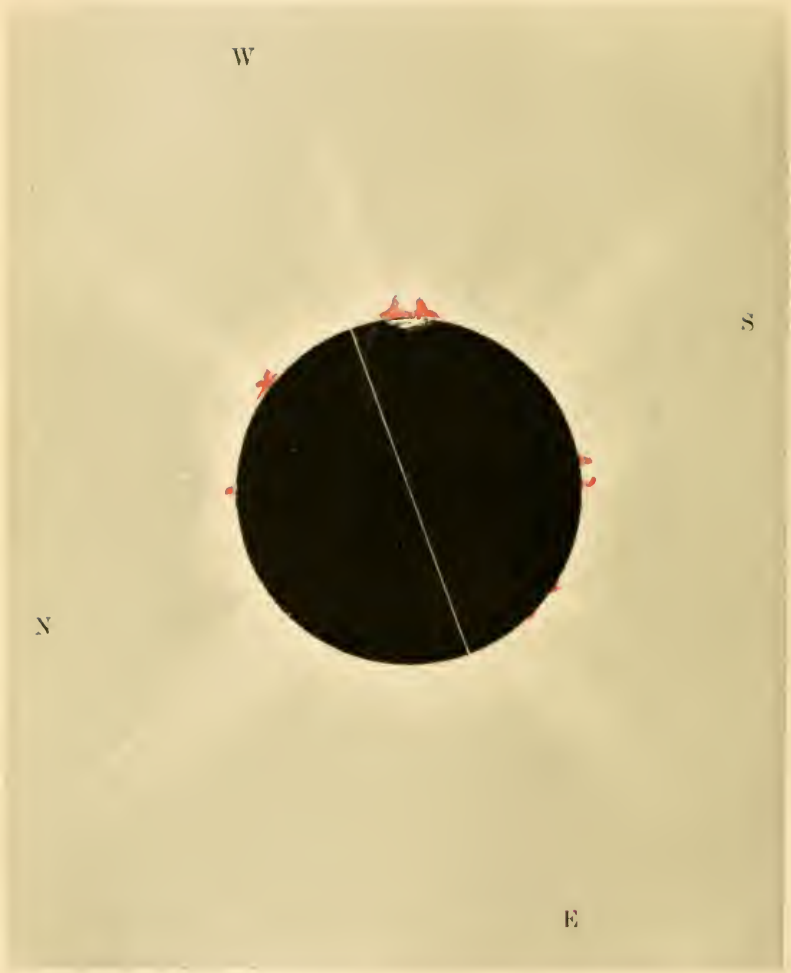
From which it appears, that the apparent velocity, is directly proportional to the *magnetic force* of the circuit. Hence, we are led to conclude that in such experiments we do not determine the velocity of the electric impulse, but only the *mechanical force* of the current.

There was no difference in the apparent velocity whether the current passed from the positive to the negative pole, or *vice versa*. Neither was there any measurable difference whether the battery was all on one end or divided. It was, however, found to be impracticable to work a long circuit, say 1000 miles, with the whole battery at one end of the line.

The computed value R = 1.43 miles of line wire, is apparently many times too great, but when we consider that

no less than from 15 to 20 wires are fed from the same battery at the same time, it is not an impossible value. It would perhaps be preferable in such cases to modify the general formulæ, by dividing the electro-motive force by the number of lines fed from the battery, which would give R more nearly its true value. But there are so many modifying causes at work in such experiments, that refinement in mathematical computation is not possible, or desirable.

In case we had a Galvanometer and Rheostat, the values of e and R could be measured directly, and the magnetic force of the current at once ascertained. This is by far preferable, and we hope at some future time to continue the experiments with such apparatus.



TOTAL ECLIPSE, AUGUST 7TH, 1869.

Observed at Mattoon, Illinois.

ART. IX.—*Total Eclipse of August 7th*, 1869, *observed at Mattoon, Illinois.*[1] By Prof. G. W. HOUGH, A. M., Director of the Dudley Observatory.

[Read before the Albany Institute, October, 1869.]

The station chosen by the Dudley Observatory party for the observation of the total eclipse was at Mattoon, Illinois.

The latitude and longitude of the station had previously been determined by the United States coast survey: latitude 39 deg., 29 min., 10.5 sec.; longitude 45 min., 20.2 sec., west of Washington.

Prof. J. H. C. Coffin, Superintendent of the Nautical Almanac, kindly furnished us with the necessary data for the observation of the phenomena.

Observers.

The corps of observers was composed of the following persons:

Prof. David Murray, Rutgers College, New Brunswick. Telescope 3 in. achromatic, 3 ft. 4 in. focus, power 35.

Mr. Lewis Swift, Marathon, N. Y. Telescope $4\frac{1}{2}$ in. achromatic, power 36.

Mr. J. C. House, Waterford, N. Y. Telescope $3\frac{1}{4}$ in. achromatic (direct vision), power 35.

Mr. Thomas Simons, United States Attorney's office New York city, Prof. L. F. M. Easterday, Hillsboro, Ill. Telescope transit, 2 in. objective, 2 ft. 6 in. focus, power 30.

Prof. Twining, St. Louis, and Rev. Mr. Marshall, Indianapolis. Naked eye observations on stars visible.

[1] Read at the Salem meeting of the American Association.

General J. W. Keifer, Springfield, Ohio, C. B. Bostwick, Mattoon, Ill. Naked eye, observations on corona, &c.

Prof. F. H. Smith, Mattoon, Ill. Observation of sun thermometer.

President Thomas Hill, Cambridge, Mass. Naked eye observations on corona, shadow and other phenomena.

Prof. G. W. Hough. Dudley Observatory—Equatorial comet-seeker, 4 in. objective, 3 ft. 6 in. focus, power 44.

The station at Mattoon was near the west side of the school building, twenty feet north of the South monument, erected by the United States Coast Survey. The position was a good one, as there was an uninterrupted view to the south, west and east.

In the south-west room was mounted the sidereal clock and chronograph. The clock was a compensated mercury pendulum, made in two sections for facility of transportation; the mercury being held in an air tight iron cylinder. This clock was made expressly for the eclipse expedition by Charles Fasoldt, of Albany, to whom we are also under obligations for a mean time pocket chronometer, beating three times per second.

Before packing, the clock was set up in the Observatory, and rated on sidereal time, and the necessary connections attached for recording minutes and seconds on the chronograph. Its running for nearly a week, as compared with the standard clock, showed a steady and reliable rate. On arriving at Mattoon, Aug. 2, it was immediately mounted on a solid brick wall, and started on Mattoon sidereal time, as deduced from the watch by applying difference of longitude, &c. In the afternoon of the same day, by comparison with the watch, it was found going too slow. A small brass weight equivalent to five seconds per day on the rate, was placed on the pendulum. After which time it was not disturbed. By subsequent comparisons with Dudley Observatory time, obtained by means

of the telegraph, its rate was ascertained to be fifteen seconds slower, daily, and the arc of oscillation a little shorter than when running at the Observatory. On its return, after being cleaned, it was again set up, when the rate was found to be essentially the same as at Mattoon.

Time.

To Mr. Orton, the president, and Gen. Anson Stager, superintendent of the Western Union Telegraph Company, we are especially under obligations for putting a continuous line of telegraph wire of nearly one thousand miles in length at our disposal, for the purpose of securing time from the Dudley Observatory. Our thanks are also due to the managers of the following offices, all of whom were interested in the success of the work: Mr. C. S. Jones, manager of the Albany office; Messrs. Hucker and Slacer, Buffalo; Messrs. Wright and Tindall, Cleveland; Messrs. Armstrong and Warren, Cincinnati; Mr. J. F. Wallack, Indianapolis; Mr. Patten, of Mattoon. The necessary connections at the Dudley Observatory were made by Mr. Thos. E. McClure and Mr. H. L. Foreman.

A continuous circuit was secured on the nights of the 5th and 7th, when the Dudley Observatory sidereal and mean-time clocks were compared with the clock and chronometer at Mattoon.

The mean daily rate of the clock was found to be 15.34 seconds slow. As the last comparison with the Dudley Observatory time was only 5 hours after the eclipse, it is presumed the time was very accurately determined.

Chronograph.

The chronograph used for the eclipse observations was of the cylinder form, and was constructed expressly for

this purpose. The cylinder was 6 inches in length and 10 inches in diameter, driven by clock work regulated by the Frauenhofer friction balls. For securing a motion of stable equilibrium, an escapement held by a light spring was connected with the shaft next to the friction balls, which was regulated by a magnet beating every two seconds, by opening and closing the circuit with the pendulum of the clock. The sheets were previously ruled for every minute, and the clock dots were recorded every two seconds. A second pen was employed for recording the observations. The connections were so arranged on the clock, that at the end of every minute, the clock pen recorded in addition the 61st second, thereby giving the zero of the clock with absolute certainty — the whole mechanism performing in a very satisfactory manner. In order to enable more than one observer to use the chronograph during the progress of the eclipse, wires were connected with the clock pen and battery, so that observations could also be recorded with it. It was so used by Mr. Lewis Swift.

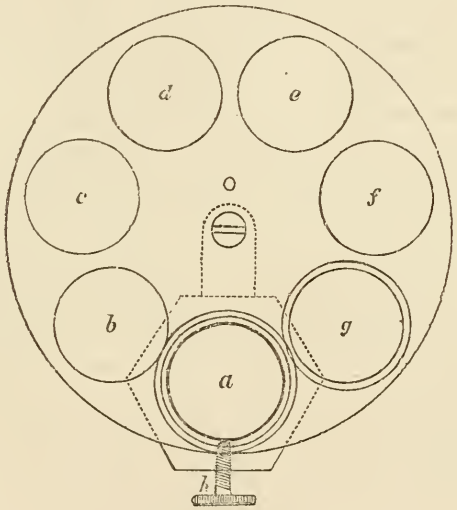
Another set of wires were connected with a battery and local sounder-magnet, placed near the observers. This magnet gave the clock beats for every two seconds and the extra beat at the 61st second, by making connection through the clock pen, causing it to act as a repeater.

The Telescope.

The telescope employed by myself was the Comet seeker made by Alvan Clark. The focal length is three feet six inches, and the objective four inches clear aperture. A parallel wire micrometer and position circle divided to degrees, was constructed for this work. There was one fixed vertical and one horizontal wire, and three movable micrometer wires. The eye-piece holder was so constructed that the eye-pieces belonging to the transit instru-

ment could be used. A brass tube held in position by a set screw, was fitted over the eye-piece, to which was attached a disc of brass, three and a quarter inches in diameter, in which was set six plates of glass of different colors and density.

This apparatus is here represented, on a scale two-thirds the full size. The colored glasses are marked, *b*, *c*, *d*, *e*,



f, and *g*. The latter was provided with a cap, for holding a double or triple glass. The position of the eye-piece is at *a*. When in the position here represented, no colored glass is over the eye-piece. The set screw, for clamping to the eye-piece tube, is at *h*. In order to bring any one of the colored glasses over the eye-piece, the plate is revolved about the centre *o*. By this arrangement, any color can almost instantly be brought before the eye. It has been surmised from the observations of previous eclipses, that perhaps the color of the glass used, might materially

modify the phenomena. This apparatus was constructed for the purpose of testing it.

It may here be stated, that the color of the glass had no appreciable effect on the character of the phenomena.

For the observations during totality no colored glass was used.

For regulating the aperture of the objective, holes of one, two, three and four inches in diameter were cut in a disk of thick card board. This was firmly screwed to a block and made to revolve in front of the objective, by means of a hand rod attached to the side of the telescope tube. A spring dog, dropping in a notch, always brought the opening over the centre of the objective.

The telescope was equatorially mounted with hand rods for giving slow motion in right ascension and declination. A day or two previous to the eclipse, three posts were firmly set in the ground for the observing stand. The telescope was brought in the meridian and appropriately adjusted for the latitude of the place, by observations on the sun, made some time previous to the beginning of the eclipse.

The eye-piece used during the eclipse gave a power of 44.

The Weather.

The night preceding the day of the eclipse was one of unusual anxiety to the observers, from the fact, that about six o'clock it began to rain, and continued almost without intermission until 11 P. M. In order to learn the worst we went to the telegraph office and asked for weather reports from west and east. At nearly all the stations from which reports were received, extending from Omaha to Cincinnati, it was rainy or cloudy. These reports led us to expect a storm extending over a large area of territory. And it was presumed that it would be a day or two in

passing over. But fortunately our prognostics were in error, for at 11 o'clock P. M., the rain ceased and stars began to make their appearance. The morning of the 7th was clear, with not a cloud to be seen, and it so continued during the whole day and subsequent night. It was one of those rare days but seldom seen in this climate: the atmospheric disturbance being at a minimum.

The Eclipse.

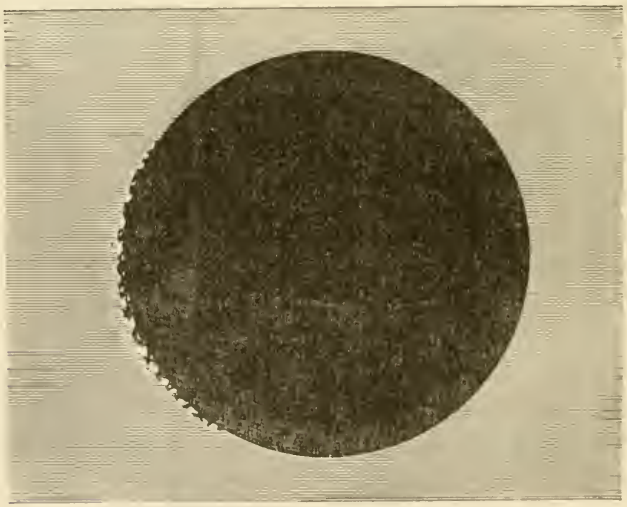
One hour before the beginning of the eclipse, observations were made on the solar spots, and their position and magnitude mapped on a diagram prepared for the purpose. As the time drew near for the first contact of the moon's limb, each observer examined carefully the region where the moon was expected, to see whether it would be visible before contact with the solar disk. The closest scrutiny of five observers failed to discover it.

At 10 seconds before the true contact of the limbs, a lunar mountain, distant 8 or 10 degrees north of the contact point, plunged into the solar disk and was recorded on the chronograph. The true contact of the limbs was well observed by all and at nearly the same instant. The moon's limb, instead of appearing round, as it should, was nearly flat and a little notched, showing a mountainous region. As the eclipse advanced, observations were made by means of the micrometer and chronograph, to determine the relative position of the two bodies. When the sun was about one-half eclipsed, a red band of light was seen surrounding the limb of the moon over the solar disk. Later, during the progress of the phenomenon, tails of light were seen projecting out tangent to the moon's limb and extending 15 or 20 degrees along the edge.

As the crescent of solar light grew less and less, every eye was intently watching for any unusual appearance.

Nearly a minute before totality, we saw with wonder a red flame suddenly shoot out from the upper edge of the moon, and shortly after, the remarkable and beautiful phenomenon of Bailey's beads. The slender crescent of light was suddenly broken up in numerous globules, resembling drops of water flowing together, or a string of beads. One observer compared it to a chain of sausages of unequal lengths.

This peculiar breaking up of the solar crescent was noticed by Bailey in 1836. But during subsequent eclipses it has not generally been seen. This fact has led some of the ablest astronomers to doubt its reality, believing it to be an optical illusion.



The accompanying wood cut is intended to represent the appearance of this phenomenon, but it can only be regarded as an approximate illustration.

At Mattoon, the appearance was distinctly seen by all the observers, and its duration recorded on the chrono-

graph by Mr. Swift and myself. That the phenomena is-real we have no doubt. It is well known that the limb of the moon is exceedingly rough and jagged, with mountains projecting to a great height. Now it is reasonable to suppose that when this mountainous limb of the moon cuts off the slender crescent of light it must be more or less broken up in sections, depending on the irregularities of the surface and the position of the observer. We are more strengthened in this opinion, since previous to the first contact, Mr. Swift saw five mountain peaks on the moon, and he reported the beads the most conspicuous in the region towards this part of the lunar disk.

The duration of Bailey's beads was accurately recorded on the chronograph by Mr. Swift and myself, and found to be five and one-half seconds. This is the first exact record ever made for the duration of the phenomena.

As the light grew less and less, suddenly the sun seemed to dart under the black disk of the moon, producing a a feeling of chilliness. Now was seen in all its splendor the large red protuberance sitting on the edge of the moon. and appearing very much like a great ship under full sail. Farther to the left was another, nearly as large, with two bent rays, somewhat resembling the antlers of a deer. Five others, not quite as large, were seen on different parts of the disk, all of a deep red color.

After looking with astonishment for a few seconds, we proceeded to measure with the micrometer the height and position of the largest flame. But just at the critical moment, fortunately or unfortunately, one of the hand rods for moving the telescope came off, and it was necessary to remove the eye from the tube to fix it. On looking up, one of the grandest spectacles met the eye of which it is possible to conceive. Surrounding the dark body of the moon was a crown of light, with rays shooting out in five great sheaths, to a distance equal to the sun's diameter,

or nearly a million of miles. For a time everything else was forgotten, and we gazed, for eight or ten seconds with astonishment akin to awe, at this magnificent spectacle. No painting can represent it, and no pen can describe it. It is one of those sights which must be seen to be appreciated. But we soon realized that precious moments were slipping away. The telescope was again brought in position and the observations continued. While still gazing, a ray of light suddenly flashed forth, and the total eclipse of August 7 was over.

The duration of totality, according to the chronograph records, was two minutes and forty-two seconds.

The accompanying drawing, prepared by Prof. David Murray, from the combined observations and sketches of all the observers, will give a general idea of the appearance of the corona, and the red protuberances projecting from the disk of the sun.

The drawing represents the sun as seen through an inverting telescope. The line across the disk of the moon, is the projection of the earth's equator.

Owing to the difficulty of representing by any drawing a phenomenon of this kind, no great degree of precision is attainable.

A sketch of the corona was made during the time of totality by Mr. Bostwick, of Mattoon, and General Keifer, of Spingfield, Ohio, and is presumed to be a pretty faithful representation of the position and magnitude of the rays.

Prof. David Murray, at my request, prepared a paper on the physical phenomena, which is here appended.

Physical Phenomena.

"The peculiar phenomena which have attracted so much attention in solar eclipses, are only visible during the brief period of totality. This in the present case, only

extended through two minutes and forty-two seconds. The difficulty of observing them lies in this exceeding brevity, and in the fact, that no matter how much the observer may have studied the experiences of others, the phenomena come upon him as a complete surprise. The moment the last ray of light disappears with the extinguishment of Bailey's beads, there bursts upon him a vision so marvelously beautiful, so startling by its novelty, that his self-possession and self-control desert him, and leaves him for an instant a helpless gazer. As soon as he can collect his thoughts and tries to marshal them into order, he will find especially two phenomena of notable interest:

1. *The Corona.*

"In immediate contact with the solar disk it appears as a clear silvery light, as bright as the brightest part of an aurora, and somewhat resembling it in consistency. Farther out it appears streaked with pencils radiating in the direction of the centre. These rays are more especially noticeable at five points of the circumference, two of them pointing upwards and outwards, and three having a general downward direction. These prongs could be traced through a distance, even exceeding the diameter of the sun, and near one of them was visible a curved mass of light, in shape resembling the petal of a flower. On the upper edge of the disk was plainly seen an arch of light, parallel with the edge, and within the boundary of the corona.

"It should be stated, that this phenomenon of the corona is best observed with the naked eye, and cannot be included within the field of an ordinary telescope.

"The commonly received explanation of the corona, has attributed it to an atmosphere surrounding the sun, which

was illuminated by the light of the sun in the same way that our atmosphere is illuminated in twilight. This will undoubtedly explain the luminosity found nearest the disk; but it can hardly be received as satisfactory in regard to the luminous prongs which extend out to such a great distance. It must be remembered that these prongs projected a distance greater than the whole diameter of the sun, and must have reached an attitude, if they belonged to the sun, of at least a million of miles. This is of course, beyond all possibility, and the idea of the whole phenomenon being of solar-atmospheric origin is untenable. Equally untenable must be the idea that it is a solar aurora, because an aurora supposes an atmospheric medium in which it exhibits itself.

"The impression which was firmly made upon my mind by witnessing it, was that in some way, the interstriated part at least, was formed in the earth's atmosphere."

2. *Red Protuberances.*

"The second phenomenon attracting attention, was that of the sudden appearance of a number of protuberances of various shape and magnitude, which projected beyond the black disk of the moon, and were of a bright rosy red color. We saw six or eight in all. It must be remembered that these were of immense size. The largest was not less than 30,000 miles in altitude. They seemed to have a cloudy consistency, and the form of some of them forbade the idea that they could have been either solid or liquid. These protuberances are seen in all total eclipses, but in no two are they in the same place or of the same form. They are thus shown to be of a changeable and transitory character. This was really all that could certainly be known about them, until the application of the spectroscope to celestial bodies gave us a new road to a

knowledge of them. By means of this we are able to distinguish a solid body from a gaseous, a self-luminous from a reflective body, and even more, to determine with certainty the very elements comprising the incandescent body. This mode of investigation, used first in the total eclipse of 1868, and still more in that of the recent eclipse, has revealed to us that the red protuberances are mainly a mass of incandescent hydrogen gas. The thought is overpowering. Here are vast accumulations of blazing matter reaching to a height of many thousand miles. What convulsions in the matter of the surface of our sun does this view of it reveal!

"That the spots which are seen on the surface of the sun will finally be proved to be identical with the protuberances, I venture to predict."

The most remarkable of the red flames, is that represented at the top of the drawing. It was seen nearly a minute previous to totality, and remained visible almost six minutes after totality had ended. We had it under observation during nearly the whole duration of the total eclipse. Its height was measured with the parallel wire micrometer, and found to be 1′ 05″, equivalent to 30,000 miles. It may be necessary to state, that the micrometer screw head was not read until after the end of totality. The fixed wire then stood between two movable ones, dividing the interval in spaces of 1′ 05″, and 2′ 45″. We assumed the smaller interval as the height of the protuberance; but on discussing the subject with the other observers, it was considered altogether too small. We thought it possible, there might have been a mistake in the interval used, and accordingly adopted the largest measure. But observations made at other points seem to show conclusively, that the smaller measure is the correct one. Its position was 20° to the apparent north of the equator, and its base was estimated at three times its

height. Directly under it was seen a white spot, nearly as large as the protuberance itself. This was probably its reflection on the disk of the moon. Its physical constitution is well described by Mr. Swift, in his report. While under our observation, no radical changes in its appearance were noticed. The color was a deep red near the base, gradually changing to pink towards the top.

The spectroscope shows, that these flames are hydrogen gas in a state of combustion. Its illuminating power, however, must be very great; since this flame was seen, for nearly six minutes after the end of totality. Its disappearance was peculiar and entirely contrary to our expectations. It was presumed that a luminous flame, when brought in opposition to a stronger light, would gradually grow less and less, until it finally faded away. No such phenomenon was manifested during its disappearance. It seemed to retain its intensity, until it was entirely cut off, or apparently lifted up by the advancing crescent of solar light. This phenomenon was also remarked by Mr. Swift.

Another flame to the left had two branches bent outwards, looking somewhat like the antlers of a deer. Its height was not measured, but was estimated to be nearly as great as the large one before described. To the right a small one projected out, which was bent in the form of a hook. The remaining four noticed, were small, and did not present any unusual appearance.

Stars visible.

Previous to the beginning of the eclipse, we set up a number of light wooden rods, indicating the direction of stars and planets. Prof. Twining and Mr. Marshall succeeded in seeing Saturn, eight minutes before, and Venus four minutes before totality. During the totality, Mer-

cury, Venus, Mars, Saturn, and a number of bright stars were visible to the naked eye.

Temperature.

Observations made by Prof. Smith, with a thermometer exposed to the direct rays of the sun, showed a variation of 42 degrees during the progress of the eclipse.

The observations of Mr. House, with a thermometer placed in the shade, showed a variation of 13 degrees.

Floating Bodies.

During the progress of the eclipse, all the telescopic observers noticed faint whitish bodies darting past the field of the telescope. At the time they made no impression but were presumed to be thistle down, midges or swallows. But when the observations were compared, it was found, that they were all seen falling in one direction, viz: downwards. The idea that they were meteoric is more plausible, and it is strengthened by the fact, that the time nearly corresponded to the August period of meteoric showers.

External Phenomena.

To the naked eye, a total solar eclipse exhibits one of the grandest spectacles in nature. On the sudden extinction of the light, the whole aspect of the landscape seems changed, the faces of our companions assume an ashy paleness, and all nature is surrounded with an unearthly light, producing, insensibly, a feeling of terror in the mind of the beholder.

The intensity of the darkness is not as great, however, as many have imagined. The light is about equal to that

during a clear moonlight night at the full. I found it impossible to read a coarsely divided circle, without the aid of a lamp; but I should judge that coarse book print could be read if exposed directly to the light of the corona.

The effect on plants and animals has long since been observed. A few of the numerous incidents collected by our party are appended.

A dog, at the beginning of totality, looked around in all directions, then tucked down his tail and ran rapidly under a building, from which he could not be induced to come out until after the sun's rays again appeared.

A team of horses tied to a post, became so uneasy and frightened, that it was found necessary to quickly unhitch them from the wagon.

A small child was noticed to look around in amazement, and then exclaim, "Oh, mother, it's going to thunder loud!"

During totality, frogs, which had not been heard during the day, began to croak, chickens went to roost, and hens hurriedly called together their broods. People instinctively shouted, when the first beam of light appeared.

An unruly cow, accustomed to jump into a cornfield at night, was found there after the eclipse.

During the most exciting period of the eclipse, General Keifer saw a man going at full speed across the street, who said he was going to see what his chickens were doing. He soon returned in a state of intense disgust, declaring in a very emphatic manner, that they were scratching away as if nothing had happened.

For a description of the naked eye phenomena, visible to the scientific observer, the reader is referred to the able and interesting report of President Hill.

The following quantities measured from the chronograph sheets, will show the progress of the phenomena:

	Mattoon Mean Time. h.	m.	s.	obs.
Lunar mountain in contact with the sun.....	4	11	07.5	H.
Beginning of the eclipse.....	4	11	16.8	H.
" " " ".....	4	11	15.2	S.
Red flame seen.....	5	10	50.0	H.
Bailey's Beads.....	5	11	23.6	H.
" ".....	5	11	22.4	S.
Beginning of totality *.....	5	11	28.5	H.
" " " *.....	5	11	28.0	S.
End " ".....	5	14	11.3	H.
Duration " ".....		2	42.8	H.
" " " (Naked .....eye).....		2	40.0	
Disappearance of red flame.....	5	20	06.5	H.
Red flame seen after totality.....		5	55.2	H
End of eclipse.....	6	09	09.4	H.
Duration of Bailey's Beads.....			04.9	H.
" " " ".....			05.5	S.

* Record on the chronograph sheet very faint.

The initials H, and S, refer to the observation of Hough and Swift.

These observations depend on Dudley Observatory time, using the longitude of Mattoon as determined by the U. S. Coast Survey, viz: 58m. 33.0s. west of Dudley Observatory. The probable error of the Dudley observatory clock, will not exceed $\pm$ 0.20s.

The Armature time for the "repeaters" and "relays" was found to be 0.21s. This quantity has been used in the comparison of the chronographs, at Dudley Observatory and Mattoon.

Great precision, in the observation of the beginning or end of a solar eclipse, is not at present attainable by any method. Until we have a complete chart or delineation of the moon's edge, it will be impossible to observe the contact of the sun's and moon's limb, within one second of time.

Report by Lewis Swift, Esq.

Marathon, N. Y., *Aug.* 12, 1869.

Prof. G. W. Hough,

Dear Sir: I herewith send you, as chief of our party, a report of my observations on the Eclipse of August 7th, as observed by me at Mattoon, Ill.

I shall describe the phenomena just as they appeared to me and nearly in the order in which they occurred.

The telescope used, has a 4.5, in. objective and a focal length of 6 feet, mounted temporarily for the occasion as an altitude and azimuth instrument. The eye-piece used gave a power of 36.

About two hours before the eclipse, I marked on a circular disk the positions of four of the principal solar spots, numbered *a*, *b*, *c*, and *d*, in the order in which they were severally occulted by the advancing edge of the moon.

The device used to do this, and also to measure the position of the protuberances, was constructed for the occasion as follows:

Two circular sheets of metal of 6 and 8 inches in diameter, concentrically placed upon each other, with a disk of card board between them, was graduated to 5° of arc. The centre was pierced with a hole equal to the size of the screw on the spring tube which holds the eye-piece, and which, when screwed into its place, holds it firmly. In the focus of the eye-piece was a wire, and on the eye-piece was soldered a brass spring, reaching to the graduated circle, and carrying a pencil parallel with the wire, which when revolved with the pencil inserted would trace a continuous mark; the design being to lift it while passing a protuberance, the space left, not only showing the position, but also its width.

The wire, the pencil, and the zero of the graduated disk were set parallel to the equator a few minutes before contact, by causing a small solar spot to traverse the wire across the field. Wind prevented setting it as accurately as I desired. The accuracy of measurements made in this way, depends on the nearness to which the sun and the field are brought to concentricity.

The position of four of the principal spots, were roughly as follows: *a*, 33°, *b*, 102°, *c*, 105°, *d*, 183°.

Estimated distances from sun's centre in solar radii were about, *a*, two-thirds, *b* and *c*, one-half, *d*, seven-eighths.

In this manner I recorded the position of first contact, which was about 341°. Some 15 minutes before the computed time of contact, I tried to see the limb of the moon, but with no power or aperture could I get the least glimpse of it, though I continued the effort until within one minute of contact.

A bright spot was seen on the sun near the point of contact, and the mottled appearance showed remarkably well and steady, although some dancing undulations were visible around the limb of the sun, yet on the whole, atmospheric disturbances were nearly at a minimum; one reason for it, I think, being that I took the precaution to set my instrument where it was entirely surrounded by grass.

The time of first contact was recorded by chronograph, and though well observed, I call it recorded about one and a half seconds too late, as I was deceived by an unlooked for phenomenon.

For about two seconds after the contact that portion of the sun covered by the moon was bounded by a straight line, instead of a curve, as I expected it would and ought to be. A little to the right of the point of contact were five lunar mountains. I distinctly saw them enter on

the solar disk, looking like the straight edge of a saw, whose teeth were worn to bluntness. The times of first and second contact with each of the several nuclei of the solar spots were recorded by chronograph.

The instant I saw those lunar mountains, the thought occurred to me, that if, as is generally supposed, Bailey's beads are caused by the sun being seen between them, then they ought to be seen more conspicuously in that vicinity, and I found by observation that my conjecture was fully realized. I recorded by chronograph the time of their first appearance and end. In appearance they bore but little resemblance to the illustrations in the books.

At 5h. 3m. a naked-eye observer came and announced the appearance of Saturn, and at 5h. 7m. the appearance of Venus.

A short time before the appearance of Bailey's beads I saw that never to be forgotten protuberance sitting in queenly beauty on the crest of the sun. The color was much brighter, the size much larger, and altogether much more conspicuous than any I expected to see. In fact, I was so captivated with its wonderful unexpected beauties, as to amount to a perfect fascination. So tenaciously was my eye riveted to it, that my observations on Bailey's beads were not as good as I would have been pleased to have had them. At the instant of totality, seven or eight protuberances of indescribable beauty and splendor were seen, all but one or two, being between 10° and 180°. At the first attempt to record them, a mishap occurred which for a time seriously disturbed my equanimity. My recording pencil was partly encased in a brass tube, which when inserted the spring was held by friction, but a two hours exposure to the hot sun so expanded the brass and contracted the wood, that at the first attempt to insert it, the wood was forced from the tube and lost in the grass. I had another on a shelf near by, which I must have

found, although I have no recollection of it, by which I recorded their position, only in a different manner.

The internal structure of the great protuberance was remarkable. It appeared to me to be interlaced with long narrow black stripes crossing each other like irregular lattice work. To my eye, from first to last, this feature of it, was one of its distinctive characteristics.

To compare it with something familiar, I would say it looked like a ship with her hull, masts, spars, etc., painted red, and the ropes painted black. It also looked like a red, *inverted* capital W, interlaced with fine black lines. I watched its disappearance with strict attention, and am able to give you data for computing it. As the light increased, it did not gradually fade away in all its parts, as I expected it would, but instead, it began to disappear on *the left side as soon as the slender lune of the sun arrived directly under it.* When it arrived at the centre of its base, the left half, and no more had disappeared; not a gradual fading away, but sudden extinction as though some moving object had interposed itself between me and it, and had a progressive motion equal to the advancing lune. It was a most beautiful sight to see it thus disappear a little at a time.

Another protuberance shaped like a *hook* was visible on the right side, about 90° from the other. I find it recorded at 118°. It was of unequal width throughout, and had it continued on in its normal direction, would have been nearly as high as the great one. At about a quarter of its distance from the end, it was bent upwards at an obtuse angle. You will find it represented in the drawing. It looks to me absurd, to suppose a cloud would ever assume such a singular shape, and yet the same thing has been seen before.

The most wonderful thing about the eclipse, I will now describe. I will not undertake to say it was real, but to

me it seemed as much so as the corona or the protuberances. The accompanying sketch will convey a better idea of its appearance than a long description.

At first I thought the upper edge of the moon had dropped down about a minute of arc below the upper edge of the sun, but instantly seeing that that was impossible I thought it might be caused by some false reflection on the inside of the telescope. But shaking the telescope and finding its relative position unchanged, I concluded it was a *bona fide* phenomenon and observed it as such. It was visible during the entire period of totality.

The limb of the pseudo-moon was faintly illuminated, and between *a* and *b*, somewhat strongly, and a soft mellow light was faintly reflected downwards as represented. The protuberance *a*, was plainly seen with the naked eye, looking as several expressed it, like a ship on fire.

Directly under it was a strong light visible on the moon extending downwards, as far as the protuberance did upwards, and was seen by the naked eye as plainly as the protuberance itself. After the total phase of the eclipse was over, the first question asked by the hundreds of visitors was: "What is the cause of the notch in the moon?" they thinking the light was a part of the sun seen through an open space in the moon.

The protuberance *d*, I have no recollection of seeing, but I find it recorded, or rather an attempt to record one.

Owing to the time lost by the mishap, I did not observe the corona very minutely, though I noticed it was very unequal in outline and deeply striated.

Once only did I take my eye from the telescope, and then merely to observe the general appearance of the phenomena; but finding from long continued exposure to the sun, my eye unfitted to do so, and knowing that the time for the reappearance of Bailey's beads was nearly

up, I again took my seat at the instrument. But while in the act of doing so, like a flash of lightning the shadow passed, and not only Bailey's beads but the end of totality was not seen; but seizing the wires I made the record about 2 seconds late.

The crowd, which up to this time had behaved remarkably well, thinking the eclipse ended, rushed around the instruments and broke the wires, and I was obliged to complete the records by observing the time by watch, which by comparison with sidereal clock was 53 seconds fast. My records are for:

Reappearance of centre of spot *a*, 5h. 26m. 30s.
d, 6h. 3m. 35s.
Last contact, 6h. 8m. 20s.

Respectfully Yours,

Lewis Swift.

Report by President Hill.

Mattoon, Illinois, *Aug.* 7, 1869.

Prof. G. W. Hough.

Sir: During the total eclipse this afternoon I was in an open field near a small barn, about 1,600 feet west and 550 feet south of your station. According to your request I herewith give you a memorandum of what I noticed. This memorandum has been twice read to a party of five gentlemen who were with me and they agree, after full discussion, in every statement.

A cow grazing in the field became uneasy at 5 o'clock, and started for home at 5h. 7m. Soon after a hen gathered her brood under her wings. Swallows were skimming the ground. About two minutes before the total obscuration, about 70 cocks and hens went to roost in the barn.

A flock of birds flew south in a hurried and confused manner just after the darkness became total. Soon after the reappearance of the sun, the chickens came from under the hen, then the fowls came down from their roosts, and the cocks which had crowed occasionally all the afternoon took it up by general consent and crowed vigorously.

No other animals were near us. No plants sensitive to light were in the field, and it was not until after the eclipse was over that I discovered cassia in an adjoining field. Some of us thought there was a slight deposit of dew upon the grass, but others failed to perceive it.

Venus appeared a minute or two before the total obscuration and remained visible for several minutes after the reappearance of the sun. At the instant of total obscuration Mercury, Arcturus, and Vega appeared. Even Arcturus was of a silvery whiteness. Arcturus remained visible some seconds after the total phase had passed.

We looked sharply for Capella, Procyon, Castor and Pollux, Regulus, and Altair, and also looked less carefully for Saturn, Antares, Spica and Mars, but we had nothing but our general recollection of the stars to guide us as to the direction in which to look, and we saw noing either with the naked eye or our opera glasses, beyond the two planets and two stars first mentioned. At the instant of total obscuration one or two of us had a feeling that we were seeing half a dozen stars bursting into sight at once, but we could only find the two.

The approach of the deep violet shadow in the air from the W. N. W., a little to the right of the sun, and its receding in the opposite quarter was much slower and more majestic and beautiful than we had been led to expect.

The gradual diminution of light during the eclipse, had revealed the presence of faint cirro-stratus clouds in the

horizon, of what appeared both before and after a cloudless sky. The transition from penumbra to umbra, although rapid, did not seem absolutely instantaneous, it was a sweeping upward and eastward of the dense violet shadow. This shadow then stretched from the west north-west to the east south-eastern horizon, while in the transverse direction it did not reach the horizon by 6° or 8°, and the low arch beneath was full of a deep orange yellow twilight. No difference was observed between the height of these arches. The transition from the orange yellow of the northern and southern horizon to the deep dusky violet of the zenith, during the total phase, was accomplished at an altitude of 12° or 15°, and there the violet seemed darker than in the zenith; as though two broad dark arches ran, one on each side the zenith from W. N. W. to E. S. E.

The coronæ appeared to us a white ring of 4′ or 5′ in breadth, with white rays 30′ to 35′ in length and a few white petals 6′ or 8′ in length, one of which on the right upper limb was curved. No change was observed in the coronæ during the total phase, except that one of us thought there was a tremulous flashing at the instant before the reappearance of the sun.

A crimson cloud on the lower limb was particularly brilliant; one on the left limb was brilliant at the beginning; and one on the right limb at the end of the total phase.

Respectfully yours,

Thos. Hill.

Report by J. C. House, Esq.

Waterford, *Aug.* 16, 1869.

To Prof. G. W. Hough:

Having been so kindly received by yourself and given a place among your party of observers during the recent eclipse at Mattoon, I take pleasure in transmitting to you the results of my observations.

My station was near that of your own (about 5 feet N. W, as marked on the diagram. The observations, were made with an achromatic telescope 3.25 inch aperture, with a terrestrial or direct eye-piece, having a power of about 35. A convenient arrangement for reducing the aperture was attached to the telescope tube. In the shade of the brass standard supporting the telescope was suspended a Fahrenheit thermometer having an ivory scale, with which the observations for temperature, during the progress of the eclipse, were noted.

A portion of the observations were timed by a watch previously set to Mattoon mean time, but the most important coinciding with your own, which were recorded by the chronograph within my hearing, I did not note the time. I did not see the first contact of the projecting surface of the moon, but caught the real contact of the moon's limb, at the instant I heard your signal key record the same.

At 4h. 30m. 0s., by watch, as the moon's limb advanced, I noticed its eastern edge slightly tinged with red.

At 4h. 35m. 40s., by watch, noted the contact of moon's limb with 1st solar spot.

At 4h. 52m. 24s.	with	2d	Central group.
" 4h. 54m. 20s.	"	3d	
" 4h. 56m. 42s.	„	4th	

While sweeping the disk in search of the red protuberances if any should appear before totality, I missed the contact with the large eastern spot, but noticed soon after the formation of Bailey's beads, and as I heard the signal key record the time, I did not note it by the watch. The beads appeared to me to cover about 60 degrees of arc, and their duration to be from 5 to 8 seconds. They were somewhat irregular in their formation and of different lengths, but presenting a very beautiful appearance. Appearing as they did at a point coincident with the mountainous or rough edge of the moon, observed at first contact, it seems to me not difficult to account for their formation.

My observations of the total phase was also coincident with the record of your signal key, and as soon as noted, I commenced sweeping the disk for the red protuberances. I was first struck with the size and appearance of the one on the lower quarter, then the double hooked one on the western edge, and then the two upon the eastern side, as marked in the accompanying diagram. The color was of dark deep red, having a somewhat lighter shade near the outer edge.

I was also conscious for a few seconds of the appearance of a continuous series of small ones or rather perhaps a red line with an occasional break on the S. W. quarter.

My observations of the corona were imperfect in consequence of not taking it all in the field of my glass. It showed white rays of varying lengths in different positions, giving the appearance of fine points. With regard to its general features, my impressions accord well with the diagram prepared by Prof. Murray. I, however, received an impression of its assuming a roseate tint near the end of totality. I regret that I had not been more particular in my observations, as the apparent change of tint does not appear to have been noticed. Probably it was an effect produced by the colored shade I had previously used.

The burst of sunlight at reappearance seemed instantaneous, and so brilliant and overpowering that I omitted to note the time. The change of temperature during the progress of the eclipse was very marked, every one noting the chilliness increase as the shadow advanced. The thermometer showed the following record in the shade:

3h. 30m.	P. M.	before eclipse	80°
4h. 10m.	"	at beginning of eclipse	77°
5h. 0m.	"	eclipse partial	70°
5h. 12m.	"	" total	64°
5h. 30m.	"	" partial	68°
6h. 10m.	"	" ended	70°

showing a change of 13° during the progress of the eclipse.

Both before and during the eclipse I saw in the telescope shooting swiftly across its field, a number of bright white objects, perhaps 20 in all, never more than one or two at the same time, generally moving in the same direction, downwards. It is possible they might have been small meteoric bodies, but I imagined at the time that they were insects.

Yours, very truly,
J. C. House.

Observations of Thermometer in the Sun by Prof. T. H. Smith.

Mattoon M. Time.		Temperature.
3h. 40m.		100°
3h. 45m.	cool wind	97°
3h. 50m.		99°
3h 55m.		102°
4h. 00m.	breeze	98°
4h. 05m.	"	96°.5

Mattoon M. Time.		Temperature.	
4h. 10m.		97°	Beginning of Eclipse.
4h. 15m.		96°	
4h. 20m.		94°.5	
4h. 25m.		94°	
4h. 30m.		90°	
4h. 35m.		90°	
4h. 40m.		87°	
4h. 45m.		85°	
4h. 50m.		81°	
4h. 55m.		76°	
5h. 00m.		72°	
5h. 05m.		67°	
5h. 10m.		62°	
5h. 15m.		60°	Totality.
5h. 20m.		61°	
5h. 25m.		63°	
5h. 30m.		69°	
5h. 35m.		69°	
5h. 40m.		72°	
5h. 45m.		76°	
5h. 50m.		80°	
5h. 55m.	breeze.	77°	
6h. 00m.		74°	
6h. 05m.		75°	
6h. 10m.		73°	End of Eclipse.

Art. X.—*Fungi.* By Chas. H. Peck.

[Read before the Alb. Inst., Feb. 15, 1870.]

Mushroom, toadstool, smut, mildew, mold and rust are familiar names applied to various plants, all of which are included in the more general and scientific term *Fungi.* These constitute a large class of cellular, Cryptogamous plants, generally small and often microscopic, extremely diverse in form, habits and appearance, yet in all their diversity retaining certain characters common to all.

It is a favorite rule with skillful instructors to begin, in teaching, with the elementary principles of a science, to assign as first lessons that which naturally precedes all the rest and which is less complex in character. Botanists appear to a certain extent to have reversed this rule. They have studied thoroughly the higher and more complex forms of vegetable life, they are familiar with the names, history, habits, classification and uses of these plants, but they seldom claim even a moderate knowledge of the simple, cellular, Cryptogamous plants, and least of all, of the Fungi. Through the efforts of Drs. Torrey, Gray, Wood, Eaton and others, among whom is our own lamented Dr. L. C. Beck, the Phænogamous plants of our country have been quite thoroughly investigated and carefully described in manuals adapted to the wants and within the reach of all lovers of botanical knowledge. Mr. W. S Sullivant has written a descriptive manual of our Mosses, and, aided by L. Lesquereux, a most excellent bryologist, has illustrated it by two editions of sets of dried specimens. A similar work has been

done among the Lichens by Prof. E. Tuckerman, while the late lamented Dr. W. H. Harvey, under the auspices of the Smithsonian Institution, has described and figured in an admirable manner, a large number of our Algæ. But no one has been found to write a treatise upon or perfect a manual of our species of Fungi. That class of Cryptogamia which exceeds all others combined, in its number of species, and which is full of interesting peculiarities, has been strangely neglected.

It might be interesting to dwell a little upon the probable cause of this neglect, to inquire if a toadstool really is such a repulsive object, or if there really are such formidable difficulties in the way of their investigation as this aversion of botanical authors would indicate. But as it is our purpose merely to give a simple rehearsal of what has been published on this subject in our country, to call attention to some of the more conspicuous and interesting traits of these singular plants, and to point out some of their more important relations to other objects, we will at present dismiss that inquiry.

L. D. Schweinitz was one of the earliest and most active mycologists of this country. His "Synopsis of the Fungi of North Carolina" contains a list of nearly fourteen hundred species, of which three hundred and ten, or nearly one-fourth, are described as new species. The descriptions are in Latin and generally brief. This was followed in 1834 by his "List of North American Fungi," published in the Transactions of the American Philosophical Society, second series, Vol. IV. It includes the names of nearly thirty-one hundred species, of which more than nine hundred are described as new. These descriptions also are in Latin and much more full and satisfactory than those of the former list. In neither case, however, are the dimensions of the spores of the microscopic species given, a character sometimes quite important. Most of

the species in this list were found in the Carolinas and in Pennsylvania.

In 1849 a Catalogue of the Plants of Cincinnati collected by Thomas G. Lea was issued. In the Catalogue are the names of three hundred and nineteen species of Fungi, of which fifty four are described as new, the descriptions, drawn up by Rev. M. J. Berkeley, being given both in Latin and in English. There are descriptions, in Eaton's Botany, of nearly four hundred species, but they are scarcely sufficient for the satisfactory identification of the species, being necessarily reduced to the greatest brevity on account of the comprehensive character of the volume.

Dr. Curtis's "Catalogue of the Plants of North Carolina," issued in 1867, contains a list of almost twenty-four hundred species of Fungi of which four hundred and ninety-one are new species and referred to the joint authorship of Berkeley and Curtis. Descriptions of a part of these may be found in Silliman's Journal. Sets of dried specimens in four volumes, each volume containing specimens of one hundred species, have been prepared by H. W. Ravenel of South Carolina. The names are neatly printed on the labels and each volume has a printed index of its species. These specimens afford a valuable aid to the student of mycology. A few other local lists of species and an occasional short article in scientific journals complete our present literature of the Fungi. From the foregoing data it appears that descriptions of only about fifteen hundred of our species have been published in this country, and that about twelve hundred of these are in Latin alone so that they are not available to students unable to read that language.

The present classification of Fungi is essentially that introduced by the celebrated Cryptogamic botanist, Elias Fries, in his "Systema Mycologicum." There are five principal divisions; viz, the Hymenomycetes or *membrane*

Fungi, in which the membranous spore-bearing surface is a prominent character; the Gasteromycetes, which may be called the *ventricose* or *bellied Fungi*, in which the spores are inclosed in the central cavity of the Fungus; the Coniomycetes or *dust Fungi*, in which the small dust-like spores constitute the most conspicuous part of the plant; the Hyphomycetes or *thread Fungi*, in which the filaments are especially developed; and the Ascomycetes or *sack Fungi*, in which the spores are contained in small delicate *asci* or sacks. The common mushroom with its radiating spore-bearing lamellæ is an example of the first kind; puff balls, filled with masses of spores beautifully explosive under sudden pressure, are examples of the second; corn smut is a familiar instance of the third; the potato mold of the fourth and the common morel of the fifth. Further divisions and subdivisions have been adopted, distributing these plants in orders, genera, subgenera and species. These subdivisions and the characters on which they are founded are interesting to botanists, but can scarcely be expected to engage the attention of others. But the arrangement of the Agaricini, the principal order of the Hymenomycetes, is so peculiar and presents so many unusual features that you will bear with me if I devote a little space to its consideration. This order contains many species and occupies the first or highest rank among the Fungi. Because of their soft perishable nature they are called fleshy, putrescent Fungi. Their texture is wholly cellular, though varying in degree of hardness and in durability according to the density of the tissue. This difference in the texture of the plants or of certain parts of the same plant and the variations in the lamellæ furnish the chief characters for distinguishing the genera. For example, if the plant is of a dry coriaceous texture with sharp-edged lamellæ it is a *Marasmius;* with thin, eroded, or serrated lamellæ it is a *Lentinus;* with anastomosing lamellæ it

is a *Lenzites;* if the texture is soft and fleshy with the edge of the lamellæ obtuse, it is a *Cantharellus;* with their edges acute and their juice milky or colored the plant is a *Lactarius;* with their edges acute but with no colored or milky juice it is an *Agaricus;* if the lamellæ dissolve into an inky fluid it is a *Coprinus.* The genus Agaricus is the largest one of the order. More than a thousand species are attributed to it in the "Epicrisis" of Fries. A genus so large is inconvenient and perplexing to the student, especially when, as in this case, all the forms can be readily seen to be mere modifications of a single type. "In no instance," says the immortal Fries, "not even among the Compositæ, does nature repeat herself in so many similar forms." Hence the necessity arises for subdivisions. In this case the divisions are into series and subgenera. The series are five, and singularly enough, they depend simply upon the color of the spores. They are the *Leucospori*, made up of species having white spores; the *Hyporhodii*, with flesh-colored spores; the *Dermini*, with ferruginous or rust-colored spores; the *Pratellæ*, with brown or brownish purple spores; and the *Coprinarii*, with black spores. It becomes necessary, therefore, in determining to which of these series a given specimen belongs, to determine the color of the spores. This can sometimes be inferred from the corresponding color of the lamellæ in mature specimens, but this test is scarcely reliable and it is more satisfactory to decide from direct observation of the spores themselves. For this purpose they are collected upon paper either black or white, according as the spores are white or not, since the color of the paper sometimes gives a peculiar hue to the spores. For instance, *Panus dorsalis* is described as having white spores because they appear thus when collected on black paper. If collected on white paper they appear to be of a beautifully delicate flesh color. In each of the above mentioned

series we find closely related forms making subgenera which correspond with certain subgenera of the other series in every respect save the color of the lamellæ and the spores. Thus the five subgenera *Mycena*, *Leptonia*, *Galera*, *Psathyra* and *Psathyrella*, belonging respectively to the five series already characterized, all agree in their slender form, subconical or bell-shaped cap and hollow stem, and but for their differently colored spores they would all have been placed in one division instead of being distributed in five. I have thus noticed this unusual use of color alone in the classification of these plants because it is without example in any other instance save that of the Algæ. These are divided into three series, red, green and olive colored Algæ, one or another of these colors not only characterizing the spores, but also pervading, for the most part, the whole plant. And it is worthy of remark that in these two classes of plants, the Fungi and the Algæ, the departure from the ordinary style of plant coloration is more wide and more general than in any other class. In the latter, the Chlorospermous division exhibits the green color, but this division scarcely constitutes a third part of the Algæ. In the former, a pure vegetable green is rarely seen. Now and then an Agaric may be found, having grayish green or brownish green tints, or a bluish green mold may remind us by its color of its vegetable character, but these are exceptional cases, not at all prevalent. We might naturally expect of plants that love to grow in secluded recesses and shaded places, or that spring up and develop in the darkness of the night, a pale sickly color or at least an absence of green hues, but we would scarcely be prepared to look among such plants for the beautiful and infinitely varied shades of yellow, red and brown that are so prevalent in the Fungi. The colors are sometimes brilliant, but more often without especial splendor. It is rarely that an in-

dividual plant exhibits a great variety of colors, though a species is sometimes variable in color. Generally the margin of the cap is paler than the disk or central portion, but seldom of a different color. When different colors do occur in the same plant they are generally found in different parts of it, as the stem, lamellæ or cap, or as differently colored zones or belts encircling the disk of the cap. The prevailing colors of the microscopic species are yellow, orange, brown and black. The colors of the soft fleshy Fungi are very imperfectly retained in drying, while those of the dry coriaceous species change but little.

Passing from the consideration of color to that of number, we may safely assert that the Fungi in number of species as species are now understood, not only far surpass any other division of Cryptogamic plants, but probably equal or even exceed all these combined. By referring to the catalogue of plants of North Carolina, and the reference is made with much confidence, since the author has been an enterprising life-long botanist and the list is without doubt very nearly a complete one, we find the whole number of species recorded to be 4,849, of which 1,873 are flowering plants and 2,392 are Fungi, showing an excess of Fungi over the flowering plants of 519 species and that with thirty-two more species of Fungi they would constitute one-half the entire flora of the State. It is quite certain that these proportions do not exist in every locality, but they afford good ground for considering the number of species of Fungi in any locality greater than we are accustomed to think. There are comparatively few species of flowering plants that have no species of Fungus parasitic upon them, either while living or decaying. And sometimes a single species is subject to the attacks of a half dozen of these parasites. The question naturally suggests itself, if these plants are so numerous why is it that they are so seldom seen? Chiefly for two reasons. A vast number of them

are quite minute, inconspicuous even when occurring in considerable numbers, forming small spots on leaves or pustules on twigs, occupying mere chinks in bark or making mold stains on damp decaying organic matter. Again a considerable number of species, though sufficiently large to be noticeable, are ephemeral in character and grow especially in deep woods, lonely swamps and dark ravines, places seldom visited save by the most ardent lovers of nature. Therefore while the watchful and scrutinizing botanist may detect many species of these plants, the superficial observer will notice but few.

If we consider their number in respect to individuals instead of species we shall find the larger ones, at least, to fall far behind most species of flowering plants in abundance. The grasses form a continuous green carpet in lanes and pastures; weeds, if left to themselves would crowd and choke our cultivated plants; and a few species of trees by the multiplication of individuals form dense groves and extensive forests. On the other hand the larger Fungi are seldom found in extensive patches. They occur most frequently in small tufts or collections of few individuals, scattered here and there, often at distant intervals. The rule among them appears to be, the larger the plant the fewer the individuals. Occasionally, under favorable conditions of location and weather, some species may be found quite plentifully sprinkled through considerable tracts, but it is not usual. Among the microscopic species, however, individuals are numbered by hundreds and thousands. Indeed they could scarcely be detected except for the aggregation of a multitude of plants.

The conditions of growth in Fungi are in some respects peculiar. The germination of the spores gives rise to delicate, creeping, interlacing filaments, called in botanical language *mycelium*. From this mycelium, in due time and under favorable conditions of moisture and temperature,

the fruit bearing part of the plant develops. A full supply of moisture and a moderately high temperature are necessary for the growth of most Agarics. He who seeks them in time of prolonged drought, will seek in vain. A correspondent writes thus; "My journey to the Cumberland Mountains was tolerably pleasant, but the weather was dreadfully hot and dry, even on their summit. Not a mushroom did I see. We have had scarcely any about here since spring. On the 3d inst. we had a hard rain, the first in a long time, and the next day I found an abundant crop of pink gills, (*Ag. campestris.*)" In ordinary dry weather Agarics may be found in shaded swamps when not occurring elsewhere. From one-half of a certain swamp in a neighboring town the trees and bushes had been cleared. In passing through the cleared portion of this swamp, two species of Fungi were found, they being species commonly growing in places exposed to the full rays of the sun; but in passing on through the wooded shaded portion, twelve species were detected. It should be stated that in spring and early summer, comparatively few species occur, no matter how copious the rains or moist the atmosphere.

The black-spored *Coprinarii* and the vernal species and such as recur throughout the season, as *Agaricus laccatus*, *Agaricus campanella*, etc., are the principal ones then to be found. This part of the season seems to be required for the development of the *mycelium*. But let frequent showers and warm rains occur from July to October and the harvest of Agarics will be abundant. If the weather be not too cold nor too dry they continue quite plentiful until the frosty, freezing nights of November put an end to their further development. The season of 1868 being quite warm and toward the latter part abounding in rain was one very favorable to the growth of Agarics. The past season, 1869, though by no means excessively dry in our section, was less productive of these Fungi, owing doubtless to the gene-

ral coolness of the atmosphere. It was also observed that the spores were not shed in a very low temperature. Several specimens were placed upon paper for the purpose of collecting their spores and put aside in a cool room. They remained two or three days without giving any signs of fertility, but the weather becoming warmer, these same plants yielded a copious supply of spores.

The small species, parasitic upon the leaves and tissues of living plants seem to be less dependent upon the moisture of the atmosphere for their growth as they derive a part of their nourishment from the plant they inhabit.

The rapid growth and short continuance of some species has given rise to a proverbial expression signifying sudden development and speedy termination and decay. It is true that some species, and especially some *Coprini* spring up in a night and wither in a day, but more require a longer period for their growth. Some continue a great part of the season and a few tough species of *Polyporus* are perennial. It has already been stated that most Fungi are of small size. Occasionally specimens are found comparatively large. I have seen specimens of *Polyporus lucidus* more than a foot in diameter and weighing nearly two pounds. An individual of some unknown species, probably a *Polyporus*, was reported to me from the Lake Superior region to be three feet in diameter. An oblong or kidney-shaped puff-ball which I have not yet been fortunate enough to find, has been reported to me two or three times and is said to be from eighteen inches to two feet in length. Another puff-ball, *Lycoperdon giganteum*, attains a diameter of five or six inches, or even more. The liver Fungus, *Fistulina hepatica*, is said to grow sometimes sufficiently large to furnish four or five men with a dinner from a single plant. It is even affirmed that it sometimes attains a weight of thirty pounds.

The odor of many species of Fungi is not very decided, still there are some species in which it is very distinct; in

one, agreeable, in another disagreeable. It is in some instances very perceptible while the plant is fresh, but disappears when the plant has become dry; again it is very very slight in the fresh state of the plant, but distinct enough in the dry. *Lactarius glyciosmus* is an example of the first kind, *L. camphoratus*, of the second. The odor of the last, however, is more like that of melilot or dried *Cyperus inflexus* than like that of camphor. Some species emit an intolerable order while drying or decaying, although not offensive while growing. Some species have the odor of radishes, others, of aromatic plants, and some of new meal. Odor in some instances affords a very good character for readily determining species.

Fungi not only vary in fragrance, but also in flavor. Generally in the raw state they have a mushroomy or fungoid flavor more or less distinct and not especially agreeable to a palate not educated to such a taste. Aside from this, many species have a taste peculiar to themselves; one which, like their odor, may be of service to the student in the identification of species. This flavor is in some cases similar to the odor of the species. It may be sweetish, bitter, nauseous, in some, like meal, in others, like rich oily nuts, and in the *Lactarii* especially, it is frequently acrid, that is, hot, pungent or peppery, rivaling in some species the pungency of the famous Cayenne pepper. In the case of *Lactarius piperitus*, this pungency disappears by cooking, so that this species is classed with the edible Fungi, although far from palatable in the raw state. The flavors of various species when cooked have been compared to the taste of beef steak, lamb kidney, brain fritters and fried oysters. Fungi are propagated by spores and by their mycelium. The fertilizing process is yet involved in some mystery. It has not been fully shown whether the fertilization takes place in the mycelium or primary state, or in the fully developed plant. Upon the lamellæ of Agarics some of the cells are

found to produce little points or spicules each of which bears a spore at the apex. Other cells, generally a little larger, bear no spores. These have been supposed to be the male organs, corresponding to the antheridia in Mosses or the stamens in flowering plants. The impregnation may also be supposed to take place in the mycelium, in a mode analogous to that of some Algæ, the contents of the cells of one filament being mingled with those of the cells of another by means of the previous union of the contiguous cell walls. This would nearly correspond in point of time with the fertilization of Ferns, it occurring in them in an early stage of the existence of the plant. It is not improbable, indeed, that both these methods may be found to have place in this large and exceedingly diversified class of plants. The typical number of the Cryptogamia is seen in the arrangement of the spores in many Agarics. If we take a small portion of one of the lamellæ of a *Panæolus* and place it carefully under a microscope it will be seen that the spores are arranged in fours, i. e.: each spore-bearing cell gives rise to four spores. In the Ascomycetes the number of spores in each sack is generally eight, a multiple of four. The exceptional cases are numerous, but not sufficiently so to make the normal number unworthy of notice; especially since it is so strongly exemplified in the quarternary division of the peristome of Mosses, the four-valved capsules of Liverworts and the tetraspores of many Algæ. The fact that Fungi may be propagated by their mycelium is observed in the cultivation of mushrooms and in the ordinary use of the yeast plant. The spores are neglected and the propagation of the plant is carried on by placing a portion of the mycelium (or *spawn* as it is called in the case of the mushroom) under proper conditions for its growth. This process is really not much unlike that employed in the cultivation of

potatoes, dahlias and many other tuber and bulb bearing plants.

Other points of interest might be noticed in connection with these strange plants, such as the tendency of some to grow in circles, their unusual places of growth, their grotesque shapes, their dual forms and their alternate generations, but we must hasten to a brief notice of their relations to other plants and to animals.

Fungi are essentially parasitic plants. Even in many instances in which the Fungus appears to grow from the ground like other plants, a careful examination reveals the fact that the mycelium is attached to the roots of grasses or of other plants, to buried sticks or bits of wood, or is creeping amidst vegetable mold or the excrement of some herbivorous animal. These plants revel upon and hasten the decomposition of dead or dying plants. Old trunks of trees, rotten wood and dead twigs are favorite abodes of many species, the mycelium creeping among the woody tissues, loosening, softening and sometimes discoloring them. The numerous instances of "dry rot" in timber are often to be attributed to fungoid origin. *Merulius lacrymans*, in this way, has proved a great pest to buildings and shipping in England. Living plants, too, and these sometimes both vigorous and useful, become the victims of these destructive little agents which have not inaptly been styled "princes of the powers of putrescence." It has been a mooted question whether parasitic Lichens are injurious to the plants they inhabit, or not; but in the case of plant-attacking Fungi there is but one side to the question so far as the plant attacked is concerned. Cultivated plants are sometimes attacked by them more unrelentingly and more fatally than uncultivated ones. This fact is exemplified in the case of *Sphæria morbosa*, a Fungus commonly known as *Black knot*. Dr. Schweinitz, more than thirty years ago, wrote concerning it as follows: "This species occurs on

our native species of *Prunus*, but I have observed no case in which it proved fatal to the tree. About forty years ago *Prunus Cerasus* was abundantly cultivated about Bethlehem, but soon after nearly all these trees were destroyed by the united agency of this Fungus and a small Cynips. So destructive were the works of these pests that our fruit-growers have not restored their trees to this day. A remedy has been sought but has not yet been found." The observations of the learned mycologist have since his time been repeatedly and sadly confirmed. In our own section, farmers have too often been made to realize the injury-inflicting power of this Fungus, by their diminished crops of plums and cherries, and eventually by the loss of their trees.

Another instance of the terrible consequences following the attack of a cultivated plant by a Fungus is seen in the potato rot. Within the last twenty-five years thousands upon thousands of bushels of this staple article of food of the civilized world have been destroyed by the insidious workings of this almost invisible enemy.

Let the variety of potatoe cultivated be one whose vigor has been impaired by long cultivation, let the tubers be planted in heavy moist soil, and let there be an abundance of warm rain in late summer and early autumn and a large per centage of the crop is quite certain to be lost.

But uncultivated plants do not always escape death at the hands of their parasitic enemies. In one instance at least I have found the choke cherry, *Prunus Virginiana*, killed by the *Black knot*. A singular case of the destruction of forest trees occurred twenty-five or thirty years ago, in the eastern part of the adjoining county of Rensselaer. In a tract of timber land of two or three thousand acres it was found that a large number of the spruce trees, *Abies nigra*, had been killed. It was said at the time that "some disease" had killed them, but no one felt called upon to

say what disease. The owners of the tract made haste to get out and work up as many of these dead trees as possible, before their decay should have progressed so far as to render them worthless. But with all their promptness they sustained considerable loss. The entire sap wood of the affected trees was in the condition aptly termed *dry rot.* Its color had changed to a pale dull yellowish hue, the woody fibres had lost their tenacity, large pieces were easily broken short off; it was in fact, soft, brittle, crumbling, dusty, rotten; and only the heart wood of the trees was of any value. Thoughts of pestilent Fungi had not at that time entered my boyish mind, but at the present time, though it is not affirmed that the trouble was of fungoid origin, I do not hesitate to say that it is probable that some dry-rot Fungus was the author of the mischief.

If we consider the relations of Fungi to animals we shall find that they as well as plants are subject to the attacks of these parasites and are sometimes deprived of life through their agency. It is, however, more often that benefit rather than injury arises from these relations. In support of the former assertion it is only necessary to call attention to the ravages of *Botrytis bassiana* among the silkworms, or to the agency of various species of *Cordyceps* in destroying multitudes of various insects by attacking them in the larval or pupal state. In the former case the injury is wrought both upon the insect, in its destruction, and upon man in his diminished crop of silk; in the latter, though the insect is destroyed, the farmer is benefited, the enemies to his crops being overcome by a Fungus innoxious to the crops and to himself. The Texas cattle disease is an illustration of the terribly pernicious effects some Fungi may produce in their attacks upon animals, a connection between this disease and *Coniothecium Stilesianum* having been traced. And there are not wanting men of great learning and

sound judgment who attribute many dire diseases of the human race to fungoid agencies.

But leaving these matters which are yet to be more fully investigated let us glance at some of the benefits derivable from Fungi. They afford food, that most direct of all benefits, to multitudes of Coleopterous and Dipterous insects. Indeed so eagerly is that food sought by them and in such numbers, that it is sometimes difficult for the botanist or collector to obtain specimens not infested by them.

Snails and slugs also feed upon them with great avidity; and here is apparent one of those beautiful arrangements of Providence so often seen in the works of Nature. The same warm showers that call into activity these slugs and snails develop also the numerous Agarics on which they love to feed, so that when they most need food they find it just at hand in the greatest abundance.

But some may say: "It matters little what good insects and snails may derive from Fungi; are they of any use to men?"

We answer they have been, and still are of no inconsiderable importance to the human race. I need but refer to the extensive employment of them in some foreign countries as an article of food. In this respect some of the European nations are considerably in advance of the people of this country. They are eaten in considerable quantities in Austria, France, Italy and Spain. In the city of Rome alone, according to Dr. Badham, the annual consumption as shown by statistics is from 60,000 to 80,000 lbs. In France the *Champignon* is not only cultivated and eaten extensively but is also made an article of commerce.

The Japanese are said to employ many varieties of Fungi for food; and in Australia, the *Mylitta Australis*, a kind of truffle, is eaten under the name of Australian bread. It is stated on the authority of Dr. Hooker that the inhabitants of Hermit island derive a large part of their

support from a Fungus that abounds in that island; and Dr. Berkeley affirms that a species of *Cyttaria* is a staple article of food among the Fuegians during several months of the year.

It may be said that such food is good enough for savages and for those who cannot obtain better; that only persons of gross habits and strong stomachs will resort to such a diet. This objection might have some place were it not for the fact that the most enlightened people do eat them, that they often adorn the tables of the wealthy and refined, that they are sometimes served up in England at the leading hotels on great public occasions, that those who have tried them, like them, and find them not only less repulsive to the taste and the stomach but also to every sense of delicacy, than are stale venison, oysters, lobsters, cased sausages, disease breeding pork and other articles of a similar nature in common use.

I take the liberty to quote the following lines from a letter of an estimable correspondent:

"There are people all over the country who would be glad to eat mushrooms if they only knew how to discriminate them. Wherever I go I am called upon to teach people the right kinds. While in C—— last August, gentlemen and ladies had me out in the woods and fields with them every day in search of these edibles. Within a small circuit there I found twenty good sorts. Many persons who had never before tasted them pronounced them '*de-licious.*' I know persons about here, where we eat them by bushels in a year who rather eat them than meat or oysters." Again he writes: "There are a dozen families in this little borough, that have a passionate love for mushrooms and eat all they can get, some preferring them to every other edible."

I can affirm from personal experience that some kinds, so far from being coarse, unpalatable and indigestible, are most savory, digestible and nutritious. Indeed from the pre-

sence of nitrogenous properties in many of them they afford an abundance of nourishment and supply to a great extent the lack of animal food; and on this account we can readily see the great advantage that would accrue to the poorer classes were food more commonly drawn from this source.

Some Fungi make an excellent catchup, others may be kept in pickle, and some may be preserved in the dried state, so that the enjoyment of this kind of food need not necessarily cease with the termination of the season of Agarics. Objection is sometimes made to the use of such food because some of the species are poisonous. But the same objection may be urged against the higher orders of plants from which we derive the chief part of our vegetable food. We have only to learn the good from the bad in one case as well as in the other.

The medical profession have placed the Fungi under contribution for some of their remedies. The use of puff-balls as a styptic and in some instances as an anæsthetic and of ergot in womb affections are sufficient examples. The various other uses to which they have been applied as of *Polyporus fomentarius* for amadou or tinder and for razor strops, of this and other related species for smudges by backwoodsmen, of *Agaricus muscarius* for intoxicating purposes and for fly poison, of the yeast plant in fermentation, and for poultices, all tend to show that these plants are not without important relations to man, and that a more intimate knowledge of them than we now have will doubtless be attended with important and valuable practical results of which we now have no adequate conception.

Art. XI.— *Narrative of a Bear Hunt in the Adirondacks.* By Verplanck Colvin.

[Read before the Albany Institute, Jan. 18, 1870.]

Gentlemen of the Institute: I have been requested by our secretary to give a statement of a recent hunt in the Adirondack wilderness of northern New York, during which I was so fortunate as to kill a large and very splendid specimen of the American black bear, after two days chase upon snow-shoes.

The comparative scarcity of the animal, the dangers and fatigues incurred in its pursuit, would render it seldom an object of the chase but for its value to the hunter and trapper, and as a trophy.

On Friday the 31st of December 1869, while deer hunting on snow-shoes with David Sturgis of Lake Pleasant, Hamilton county, in the direction of Jessups or Indian River, we struck the trail of a large bear. It was of the black species and, according to naturalists and hunters, should at this season have been hybernating. The bear had passed during the previous night, and we immediately determined to pursue him, being willing to undergo the fatigue on the mere possibility of success. Besides, we had each our theory in relation to the habits of the bear, which the successful result of this chase would settle. In the Adirondack wilderness, hunters generally hold to the opinion that bears, when adult and prime, cannot be run down by man; and that just previous to the first deep snow of winter they suddenly disappear and are not seen again till spring. Those killed in that region are ge-

nerally shot in traps in which they have been caught; or, when accidentally met with, shot on sight if the hunter happen to be prepared.

When we discovered the trail, we immediately abandoned all thoughts of deer hunting and commenced the pursuit of the bear. Sturgis was armed with a Ballard breech-loading carbine, I carried a Spencer repeating rifle [with seven shots in the magazine and one in the barrel] besides bowie-knife and revolver.

I will not tire you with the details of the first days chase; but will merely remark that the bear would go out of his road to walk the prostrate trees, and when approaching a stream, which had a precipitous bank, he would make directly towards it for a quarter of a mile to the only log spanning it. He did not hunt wood or deer-mice or other small game, which he could easily have taken, and which swarmed in some localities; but where beech-nuts were found, he turned up the deep snow and the earth in search of them. He did not descend to the valleys to reascend the mountains, but continued along the ridges, from mountain to mountain, in a south-easterly direction with an evident and reasoning purpose which was surprising. He waded into spring-holes, and followed in their beds the little slush and snow-filled streams; whereby I judged him to be fat and heated by traveling, for he loved to wallow like a pig, and came out on the snow dripping with muddy water. In this he resembled the racoon, another plantigrade, whose generic name of *lotor* is obtained from his habit of playing in the water, even though it be icy cold.

The course taken by the bear was such as to return us toward the settlements, and to bring us by evening to a road, by following which for two miles the hotel of Mr. Sturgis could be reached. Before arriving at the road I had the misfortune, while sliding down hill on snow shoes, to be precipitated from the edge of a little cliff some ten

or twelve feet, snapping the heel rivet of one snow shoe and tearing loose the foot straps of the other; filling my gun muzzle with snow and slightly wounding my left thigh, on which I fell. Sturgis had far outstripped me when I reached the road; and, being dinnerless and lame, and night approaching, I took the way to the hotel.

Sturgis had already arrived and lay upon a sofa perfectly exhausted; he declared that, trapper and moose hunter as he was, he had never been so tired. It appeared that he had followed the trail across the road into the swamp of the Cundjemonk river; across the river, through water a foot or so deep over the ice, and up an evergreen covered mountain known as Rift hill.

From where the Cundjemonk empties into the bay of the Sacondaga river, a mountain ridge follows the Cundjemonk two or three miles, on the south-east side of that stream. This ridge has two summits separated by a little valley; at the south-west is Burnt mountain, a bare and desolate rock; and at the north-east, up the Cundjemonk, is the Rift hill, darkly green with hemlocks; its name derived from a cleft or little pass that severs the summit; a cleft twenty or twenty-five feet wide, perhaps an average depth of twenty feet, with perpendicular walls. Around the summit of this mountain Sturgis chased the bear several times, yet never caught sight of the animal. When he turned and ran back on the trail, in order to outwit and meet the bear, he invariably found that the bear had done the same, and "back-tracked" also. Besides the bear would perform the technical back-track; which is stopping and walking backwards in the tracks already made, a considerable distance, and then leaping out clear of them to take another course. This generally deceives the dog, but avails little with the skilful hunter.

From Rift hill he pursued the bear to the summit of Burnt mountain, and round and round it, till at length, utterly fatigued and discouraged and night closing in, he abandoned the chase for the time.

On hearing his narrative, I formed a plan for the hunt of the following day. It was, that keeping together we should follow the trail, and that the instant he commenced circling a mountain top, as he had previously done, Sturgis should continue in pursuit while I would await the approach of the bear, who, finding a man following would not expect another waiting on the trail for his return. If this worked as I expected, it would put bruin between two fires; but, if he did not circle a mountain summit the hound, which we could put upon his track on the morrow, would with his voice tell us the course he was running, when I could cut across on the hypothenuse of the angle, and perhaps head him off and get a shot at him. Sturgis would meanwhile follow up—after the dog—and do his best to come within range and end bruin's career.

This plan met with the warm approval of Mr. Sturgis.

That evening we were the butt of the trappers, who lounged into the hotel to inquire our success. We had "attempted a thing impossible," it was a "wild goose chase," "a bear could not be hunted down so." We determined to prove the contrary.

After mending snow shoes, cleaning rifles and preparing every thing for the morrow, we retired, thankful that the chase had brought us home to warm suppers and comfortable beds.

Aroused before daylight, I again took breakfast by the light of the candle, and as soon as we could see to follow the trail, we sallied. Sturgis led his hound "Patsey," and carried on his back a knapsack containing provisions for one week—a minimum—and a hatchet for shantying,

for it was determined to pursue the animal to extremity. It was about three miles to where we would strike the trail and our course was down the Sacondaga on the ice, up the Cundjemonk to the base of Rift hill, which we then commenced to ascend. This mountain is so covered with cliffs, huge blocks of stone and boulders, windslashes of fallen trees and the like, as to slightly remind one of the Indian Pass; it was a fit retreat for the chased bear: here he would throw off the dog by climbing the boulders and walking logs across chasms. Here the crevices in the rocks afforded comfortable retreats for great numbers of porcupines, the snow was every where tracked up by them, trees barked and little paths beaten through the snow. I noticed that the track of a porcupine exactly resembled that of a small bear; having the plantigrade appearance.

At the foot of the Rift hill I separated from my companion, and, climbing the mountain, went at his request, over to a spot on the Burnt mountain, where he thought the bear would come when chased. It was about a mile from the summit of Rift hill to this place, and, if neither the bear nor Sturgis came to me, I was to judge that the bear had left the mountain, and act accordingly.

On my way over to Burnt mountain, I crossed the summit of Rift hill, through a recently deserted deer yard that was there. I discovered by the signs, that the bear and Sturgis had passed through the previous evening and scattered them and, while examining the Rift, the cleft summit of the mountain — a geological phenomenon unaccountable to me —I noticed that near the deer yard the bear had been four times. Through the Rift, along its edge, across and around it; seemingly through necessity from the conformation of the ground. This appeared to me by far the best place to await the bear, but, according to agreement, I proceeded to the summit of Burnt

mountain and there awaited much longer than I had promised.

It is unnecessary to state every incident and every move taken in the chase; I will take a few hours from my narrative.

I had stopped to sketch a beautiful lake and forest scene, for the chase seemed dull—I had heard nothing of it for some time—when, far away up the Cundjemonk, echoed the distant cry of the hound. If it came this way Rift hill was much the better place to await; I hurried round the brow of Burnt mountain into the valley and up Rift hill to a spot near the deer yard, where from a stump which occupied the centre of the glade, I commanded a position for many rods around. The Rift was about a rod to my right, and I could have a shot at anything passing through or around it; the only place where it might easily be crossed was near at hand.

In coming from Burnt mountain I had started a deer from his browse, where he was feeding on the long hanging lichen, *Usnea barbata*,—improperly moss,—depending from the dead branches of a fallen tree. As I was not prepared he escaped, but in selecting my new stand I kept him in mind, remembering also that our hound being a deer hound might take to the chase of his usual quarry instead of the bear. I seated myself upon the stump and waited; now glancing toward the vacant deer yard a few rods to my left, now at the great tracks of the bear in the snow at my feet.

It was noon when I took my new station and the sun bright and warm; snow birds, blue jays and red squirrels chirped and frisked around. A quarter of an hour passed, then, miles away, I faintly heard the hound on the Pine mountain, toward Oregon, up the Cundjemonk. Once, twice, three times and I heard the dog no more. I waited, listened; half an hour passed; three-quarters—it grew

tiresome; I felt inclined to start up and be doing, but I had lost an elk the previous fall by leaving the runway before the dog came in and — I sat down again.

Another quarter of an hour. I was leaning drowsily forward my rifle on my lap,— listening intently, however,— when I thought I heard a faint distant tramp far down the mountain.

I sat up. *Jump*, *Jump*, JUMP, JUMP, JUMP JUMP, *JUMP*, *JUMP*, *JUMP!* something came up the mountain on a long swinging canter. I heard it crash through the bushes, descend into the Rift and ascend, and, though hidden by some hemlocks, come directly towards me still at a canter. My rifle was at my shoulder and sighted, and I could not rest my left elbow on my breast for my heart thumped audibly. Another moment, and he would clear the bushes that screened him from view — No! he had stopped suddenly, and all was silent for one long minute. Then there was a slow, dubious whine, followed by a snuffing and snorts — *so* peculiar, *so* wild — that told me I was in the presence of the untamed savage, scarce five rods of the forest glade between him and me.

The snowy woods were bright as ever; the snow-birds still chirping and fluttering among the tall evergreens; could there be a bear behind those hemlocks where my rifle aimed?

Another whine, another series of snorts, having expression in them like articulate language. There was doubt, indecision, anger, surprise! hesitancy — he would be off! Aiming a little lower I guessed his position behind the hemlocks, sighted carefully and fired.

With the explosion came a shrill scream of agony — human, though bestial — it almost unnerved me. No animal that I had shot before gave such a cry; had I mistaken? The expressions Oh! Oh! Oh! *Whew*, WHEW, WHEW!

were as plainly uttered as ever by human voice, and in an agonized way that was distressing. I heard a sudden roll on the snow, then a tumble, and the animal pitched off the bluff; in a moment I was on the edge and beheld, about ten or fifteen feet down, a huge black bear — an immense fellow, biting and tearing at his bloody side. He saw me and turned, showing jaws replete with white teeth; the rifle passed to my shoulder and I fired again, but not before he leaped.

As he ran, following him closely, I fired once, twice, three times; each time he turned and showed his teeth I shot again, when he would take to flight again, scarcely seeming to be hindered by the bullets. Suddenly leaping about eight feet up to a log that ran to the opposite cliff of the rift, I saw him walking carefully yet nimbly, limping in his right fore paw, which was bloody, and it seemed to me that I must have touched him. Aiming, I fired again, and just as he reached the end of the log I discharged my piece once more; but, as I fired, he leaped on the cliff top and ran — ran but three rods, when, with a deep groan, he pitched forward and fell headlong in a heap.

This was about quarter past one, January 1st, 1870.

Leaping down into the rift recklessly, for I now began to get excited, I dashed across it and up the opposite side; I know not how, I dared not descend there in returning. In a moment I was on the opposite side of the pass; no bear was to be seen!

Rushing forward, I slid suddenly down over the icy crust on my snow-shoes, into a hollow upon the dying bear! His eyes were glaring with a yellow light of rage, and seizing my right snow-shoe with one of his hind paws, his claws catching in the net work, he struck at me rapidly with his left front paw; the long, black hairy claws seemed to make the wind whistle past my face while his jaws, over the ivory teeth of which streamed blood from

his throat, opened and shut with a sound like a steel trap. Bowie knife and revolver were in my belt, but I had no ambition to try those romantic weapons. I jerked my snow-shoe from his claws and scrambled up, back; unstrapped the shoes, pulled forward for dernier resort the knife and pistol in my belt, then, slipping another cartridge from the magazine into the rifle, stepped down to him again and held the muzzle near his breast.

He was now quiet, save his watchful, restless, glaring yellow eye, heaving sides and the deep grumbling rattle in his throat at every breath; for he was choked with blood and, besides the thick clots around his mouth, each second a great, red bubble rose from his nostrils and burst. I watched him,—with the rifle at his breast,— so full of life I thought he might be shamming; but he was dying.

I now shouted for my companion, and at length received an answering cry from far down the mountain. It may not have been many minutes, but it seemed to me half an hour ere he came within speaking distance. I called to him that I had killed the bear; breathlessly he climbed, pulling himself up by the saplings and trees; he was wild with excitement. Breathlessly he leaned against a tree, and surveyed the prize — then shouted: "You have killed the biggest bear in Hamilton County!" breathed hard a moment and continued, "many New Yorkers, whom I have guided, would have given a thousand dollars to have killed that bear!" and was beside himself.

Soon the hound came limping in, his feet cut by the crust and bleeding. Like a staunch dog, as he was, he had held to the track, and came in slowly now, wagging his tail, he knew it was all over, and his poor skinned feet did ache so on the cold snow. I led him to the bear and, lifting him, laid him on the warm furred body. He took it kindly and fell to licking his feet, so sore and bleeding.

Meanwhile, I commenced sketching; and Sturgis, after looking the bear all over, discovered that my last bullet had entered the skull near the ear and had shattered the bone in pieces. Twisting a young black birch tree into a wythe, he knotted it round the neck of the bear — three feet in circumference — and started to "snake him out" (phrase more expressive than elegant) down the mountain and along the rivers, three miles to the road and the house.

I remained a little while to sketch and to measure distances. Just beyond the hemlocks through which I fired the first shot, I saw some black hair on the snow, and taking it up found a bloody bullet wrapped in it, the lead indented and mashed, and fragments of bone inclosed. This first bullet had passed through his chest; yet he lived on! When that shot was fired I was distant from the bear four rods, four yards and one foot; being twenty-four lengths of my snow shoes and a foot. The last shot, which pierced his brain, was fired at a range of about seven rods; at that distance it is a matter of nicety, with a long-range rifle, to keep from overshooting, especially when added to the excitement the object is in rapid movement.

Hunters generally mention the fore shoulder as the proper place to aim at; for the head, they say, being always in rapid motion makes a poor mark. I fired five shots at this bear's right shoulder, and it was only at the last moment that I changed my aim to the head; with what effect I have already told. When skinned it was found that his right fore shoulder bone was broken; pierced in two places by bullets, while three other balls had entered and passed through the chest, yet so far up or forward as to escape the heart and lungs; cutting some arteries, however, from which he bled inwardly and very profusely. Heavy and large as the bullets were (three-quarters of an ounce) the muscles on his breast and shoulders were so

thick and elastic that they closed in after the bullet; even a small pencil could not have been pressed into the wounds. The sixth and last bullet entered the skull a little below the right ear, penetrating the brain, and shattering the posterior portion of the cranium. This bullet was mashed and broken in three pieces, lodging in different parts of the brain; two of the fragments have been recovered and are retained as mementoes. That he lived and offered resistance after this wound is worthy of the attention of naturalists, and bids the grizzly, the far famed *Ursus ferox*, look to his laurels. With this wound (besides the five bullets already received) brains and blood streaming out on the snow, he ran three rods — fell, yet was still fiercely ready for conflict.

I will not relate in detail what followed; how we dragged the bear out to the settlement on his glossy back; how long it took, how wearied we were, how night was upon us when we reached the road. How we laughed as we thought of the surprise of croakers — not only at our return, but at our success — of the guides and hunters who had the previous day joked us on our "wild goose chase." At length we neared the hotel, but before we reached it the settlement had taken the alarm and was around us. We had our triumph. "It was a great feat; the first bear hunted down and killed in this manner, on snow-shoes in that region;" said those hardy northern hunters.

The bear weighed over three hundred pounds before being disemboweled, and had bled so very profusely that he must have lost gallons of blood. He measured seven feet from hind claws to tip of nose; around the neck three feet; around the chest, inside the arms, four feet ten inches; diameter of chest, from outside of shoulders, two feet. Length of hind foot ten inches; length of palm of fore paw eight inches; length of head one foot.

I had him opened carefully; and examined in detail the viscera, and judge that they weighed between forty and fifty pounds, though they were not put upon the balance together, nor all of them weighed. The lungs were light colored and seemed uninjured, but had through and upon them clots of coagulated blood. The whole cavity above the diaphragm was filled with liquid blood to the amount of several quarts. The heart was very large, firm and healthy and had not been touched by the bullets. It measured five inches in length, the greatest diameter being about four and a half inches; it resembled in shape the heart of a pig. Here it may be noted that there is a singular resemblance between the vital organs of these animals; but for the human like arms, clawed paws and furred pelt, the likeness would be complete.

The liver was healthy in appearance, and both heart and liver when cooked were excellent eating. To the entrails were attached long strips of fat, yielding much oil when tried.

The stomach of the bear was to me an interesting study; I carefully examined its contents before venturing to eat any of the meat. First taking the size and shape, I proceeded to open it and found it filled with beech nuts; nor could the most careful examination of the stomach's contents evolve a trace of animal food. Had it been the stomach of a wolf, a fox, or a wild-cat the minute teeth, small bone splinters and rolls of hair of mice or squirrels and the like, would have been found; there was no trace of anything of this sort in the stomach of this bear. There might have been two quarts or more of freshly masticated beech nuts in the stomach when first opened; these he had to procure singly from beneath the deep snow, by digging it away with his paws and rooting like a hog. When started on the second day, he was ten miles from where the trail was abandoned on the first day, and had rooted over

about a quarter of an acre under the beech trees: with great labor he had turned up the earth, discoloring the snow. Notwithstanding the numbers of small animals of the mice and squirrel kind, whose burrows abounded both through the snow and in the ground beneath, in no instance had this supposedly carnivorous beast stopped to dig them. From observations, at this time and previously, of the habits of the true black bear of our state, I am forced to the conclusion that he is not a carnivorous animal. The tusks and claws, carefully examined, will be found to be best suited to digging up roots, seeds, mast and the like. The only carnivorous habit that I have observed in the *wild* bear, is that of eating the common black ant, and the grubs found beneath rocks and logs; omnivorous he may be, but strictly carnivorous he is not. His dental system, the number of tuberculous teeth in either jaw do not support it; as for his ferociousness, he is like any other animal, when wounded and cornered dangerous.

His eating flesh when kept in confinement or driven to it by starvation, is no proof of his carnivorous habits; two of the rodenta, the beaver and musquash, have been known to devour flesh, and they have no carnivorous teeth. Baron Cuvier speaks of the bears' "almost frugiverous dentition" and states that they have "three large molars on each side in each jaw, altogether tuberculous." Tuberculous teeth are the posterior blunted ones.

The following seem to me facts: that bears are naturally strict vegetarians; that when the winter is mild and open, and beech-mast, etc., plentiful, they remain out during the entire winter and do not hybernate; that when they "den," they seldom resort to caverns, but select a shelter beneath a fallen tree or windslash, where the deep snows cover and form their only blanketing; that even when strongest and most powerful they may be run down and destroyed by man. Abbe Dupratz speaks of their migrating during

winters when there was a scarcity of food; our Adirondack wilderness affords no space for the habit, if such habit they possess.

I have here the snow-shoes which I used during the hunt and which, as they are rather peculiar in their construction, may be of interest to the Institute. They differ materially from those made by our north woods' hunters; being longer and more pointed and fully netted, toe and heel, they support one better on the snow, and served me nobly throughout the chase, despite rough usage. They were made by the Indians of Maine from the raw hide of the *Cariboo* or American rein-deer, which is highly esteemed for the purpose. A light thin string of this skin is as strong and durable as one much larger and heavier, made from the coarser deer or neat's hide. An Indian made *Cariboo* snow-shoe is a marvel to our white hunters, both from the material used and the skill displayed in the manufacture. There is a fault in the Indian snow shoes however; though their length enables one to go forward rapidly, yet it is difficult to turn quickly on them; again, the toes being very pointed one is apt while running to catch in the bushes or crusted snow and trip headlong. These faults are obviated by practice, when great distances may be traveled swiftly upon them through the dense forests.

Minute details, merely interesting to hunters, I have omitted. There remains the outline of the adventure and a few notes, perhaps of scientific interest.

ART. XII.— *California and the North-west Coast one hundred years since.* By HENRY A. HOMES, A.M.

[Read before the Albany Institute, Feb. 15, 1870.]

Our familiarity of late years with the geography, the products and the increasing population of the Western empire of the United States on the shores of the Pacific, makes the reflection seem the more astonishing that a century since, this coast was unknown and had hardly been touched by the foot of an European.

It is evident from the history of geographical discovery that a century since, California, Oregon, Washington territory and British Columbia were both in their coasts and their interior almost absolutely unknown. At that time the name of California was given to all the coast that stretched north of the peninsula on the maps. More than two hundred and eighty years had elapsed from the date of the discovery of America, from 1492 to 1769, before the mere outline of its north-west coast had been traced by Europeans. From the date of the discovery of Monterey, latitude 36° 40′, and of Cape Blanc in latitude 43°, by Sebastien Viscayno (Biscaien) in 1602, for a period of one hundred and sixty years, not a new point was made on these west coasts of America, until the year 1775. Even Viscayno had gone no farther north than Cabrillo in 1542.

When we remember that Lower California had been discovered in 1535, by the same commander, Cortes, who had conquered Mexico, it certainly becomes extraordinary that a coast directly continuous with California, remained still unknown, two hundred and thirty-five years afterwards.

It can hardly be said that the question was settled in the minds of geographers previous to 1764, whether California was an island or a peninsula. Purchas upon his map of 1625, has engraved, "California was formerly supposed to be a part of the continent, but now is known to be an island," and he carries it up above the latitude of 43°, making it, as did many geographers, 1,700 leagues long. Many maps in the New York State Library, of as late date as 1741, represent it as an island, as those of Overton, Tillemon, DeFer and others, and they extend California up to latitude 45°, including New Albion. Giustiniani's atlas of 1755, makes California an island reaching to latitude 47°. Engel in 1764, tries to prove that it is not true that California, owing to the winds and tides, is sometimes a peninsula and at other times an island.

One hundred years since, the only coast of the continents of the world that had not been delineated with more or less completeness, excepting in the Arctic and Antarctic regions, was that of the north-west coast of America from lat. 35° to 80°.

The Russians under Behring in 1728 and Tchirikow in 1741 in successive voyages, had discovered points of land in America, and on the archipelagos of islands. Behring had discovered the strait that bears his name, but the discoverers were still ignorant whether what we now call Alaska belonged to America, and whether the lands which they had discovered were islands, a new continent, or the main land of America. As late as 1754 it was denied that Alaska was part of our continent. (Letter of a Russian officer, Dobbs). Bellin on a map of 1755 observes, "not known whether the Russian discoveries are islands or continents, as they did not touch land."

The observations of Sir Francis Drake in 1578 added no knowledge of regions north of 43°, but he gave a name to a portion of the coast which he saw from the deck of his

ship south of that latitude, calling it New Albion, and entered a port in latitude 38°, north of San Francisco. Cabrillo had discovered this coast before him in 1542 under the orders of Gov. Mendoza. Finally came Viscayno's voyage in 1602-3, and all discovery ceased for one hundred and sixty-five years, when the Spainards in 1769 rediscovered Monterey.

This ignorance of the western coast is strongly affirmed by the geographer Delisle, in 1755. He observes:

"The part of the southern or Pacific ocean to the north between Japan and California at present unknown is three thousand and six hundred miles wide." (*Hist. Ab.*, p. 11), Dobbs, in his account of Hudson's bay (1744) says, "I do not find that any countries have been discovered by Europeans in all that great tract between California and Japan from the latitude of 38° to the Arctic circle."

And in the same sentiment, Henry Ellis, writing the preface in 1748 to the voyage of the ships Dobbs and California says: "there lies a tract of country making part of America from the Welcome or Ne Ultra to cape Blanco in California, that is, from lat. 65° to 43° north, taking in 22 degrees of latitude and no less than thirty in longitude, having an extent of coast upwards of six hundred leagues, the coast of which wholly and the interior parts of it in a great measure remain unknown." And we see how mistaken he was in his suppositions as to the extent of this ignorance, seeing that the continent stretches west more than sixty degrees of longitude instead of thirty as he supposed. Dobbs drew his map four years before, running an imaginary coast, starting from Hudson's bay latitude 63° and from longitude 95° directly south-west to Cape Blanco on the Pacific in longitude 35°, leaving room or space between America and Asia for a continent larger than New Holland, which new continent would on his theory embrace the Russian discoveries of 1741.

The reasons for the neglect to make voyages of discovery to complete the coast outline of the new world, are not difficult to be found, notwithstanding each new discovery had excited the admiration and had been a source of wealth to the old world. The principal reasons are the following:

First: Spain, the only nation having territory on the south seas or Pacific, was satisfied with the abundant flow of wealth from her mines, and with annually dispatching ships laden with silver from Acapulco for the East India trade at the Philippines. These ships almost invariably followed the same route, sailing on the same lines of latitude, rarely north of 15°. And they feared that the extension and spread of the news of discoveries would create for themselves, rivals in trade among the other powers of Europe.

Second: The vessels of other powers that entered the Pacific, went as buccaneers or privateers or for trade, and not for purposes of discovery; such were the voyages of Drake, Cavendish, Shelvocke, Van Noort and Spilbergen and the successful one of Anson in 1743. They were satisfied in case they could fall upon the Spanish galleons laden with silver. Anson watched more than a year for the one which he captured with over a million and a half of dollars.

Third: After the discovery of the passage around Cape Horn which was mainly favorable to the Spaniards and Portuguese, the English and Dutch flattered themselves with the hope of becoming most effectually their rivals, by a northern passage either to the west or east. They were especially sanguine of securing a passage by the west, on account of the universal persuasion that the new continent was narrow in its northern parts; and they devoted themselves for centuries to securing a passage through Baffin's or Hudson's bays. As late as 1748, the

English were butting their ships against the ice in the western inlets of Hudson's bay, believing that they should come out into the vast Pacific due west or south-west, where we now find land stretching over fifty degrees of longitude. The name chosen for the ship of 1749, *the California*, indicates the region where the explorers hoped to emerge. So well convinced was the British government that the passage was through Hudson's bay, that Gov. Dobbs secured, at this late period, that £20,000 should be voted to the one who should discover a passage through Hudson's bay to the Pacific.

While master Briggs, as mentioned in Purchas (III, p. 851), was making use of the argument of the narrowness of the continent as a reason why the English should persist in making voyages by the north, the Spaniards at a very early period got out maps, on which the coast went steadily north-west by west from California for eighty degrees of longitude to the fifty-fifth degree of latitude, for the purpose one would think of discouraging their rivals from the attempts they were making. This fact appears plainly from the current maps which were published during the seventeenth century.

Fourth: The English trading companies and those of other nations concealed their own acquired knowledge of the country, and discouraged rather than stimulated all attempts at discovery, except what they made for themselves, so as to secure the monopoly of the trade in furs. That this allegation is true is manifest from the writings of Dobbs, Middleton, Ellis, Barrow and others.

Thus much we state concisely as the reasons for the long continued ignorance of the north-west coast.

I will now proceed to illustrate this ignorance and the extent to which credulity and speculation took the place of information, only a hundred years since, by exhibiting

the geographical views of Delisle, in 1752, and of Engel in 1765.

Joseph Nicolas Delisle, a member of the French Academy, and distinguished as a geographer, had for 22 years lived at St. Petersburg as Astronomer of the government, and had accompanied the Russian expedition of 1741 which discovered the land which we now call Alaska. His elder brother, First Geographer of the king of France, was called the "creator of modern geography," and died in 1720. In 1750 Joseph Delisle presented to the French Academy a memoir illustrated with maps to explain after his rich experience, his views of the geography of North-Western America. Several editions of it were published.[1] On these, maps, copies of which are in the State Library, he has drawn: First, a sea of the west, within the interior of the continent, six hundred leagues in circumference, having on its shores the great city of Quivira, and communicating with the Pacific ocean at two points. Second and third, two series of straits and lakes stretching towards Hudson's and Baffin's bays from the Pacific, running northeast by east. Fourth, the straits of Anian, communicating with the Arctic ocean.

Delisle and his associate Buache, another distinguished geographer of that day, defend this map, by arguments which they thought convincing, during the four or five following years.

The first novelty, the Sea of the West, he was led to believe in from an account to be found only in Purchas His Pilgrimes (III, 849), which was from the pen of one

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[1] Nouvelles cartes des découvertes de l'Amiral De Fonte, et autres navigateurs Espagnols, Portugais, Anglois, Hollandois, François et Russes dans les mers septentrionales, avec leur explication. Par M. De Lisle. A Paris, 1753, 4to.

Considérations géographiques et physiques sur les nouvelles découvertes Nord de la grande mer....du Sud, avec des cartes ...Par P. Buache. A Paris, 1753. 4to.

Michael Locke, being what a Greek pilot, Jean De Fuca, told him at Venice in the year 1596. De Fuca told Locke that when he was in the Spanish employment in the Pacific Ocean in the years 1592–3, he entered into the North or Arctic sea through certain straits very near those we are now agreed to call Juan De Fuca's straits, and found himself in this Sea of the West, the size of which he gave very indefinitely.

Delisle's brother had left manuscript maps of Western America with this sea, stretching over 30 degrees of longitude, which he had drawn in 1697, but did not publish till 1718, out of regard to the interests of France in Canada. It was these maps which had led Joseph Delisle to restudy the subject. They both believed that Hudson's bay could be entered from this sea. Although De Fuca is now generally regarded as a fabulist, still his Western sea remained on maps up to at least as late as 1780. Tytler says "the whole voyage of De Fuca rests upon apocryphal authority."

Notwithstanding this is the belief at present, still after the discovery of a strait near where De Fuca had assigned one, his name became affixed to it. Delisle made a most thorough study of the existence of this sea of the west, his investigations into all travels and voyages were most minute and he attempted a most painful adjustment of it with all other discoveries, both pretended and real. What acuteness of judgment would have been ascribed to him, if his elaborate reasonings, instead of having been confuted with the lapse of time, had been authenticated. He had studied Marquette, Hennepin, the Jesuit relations of New France, and every available source of information. The southern strait of entrance, Delisle derived from an account in Viscayno's voyage of an entrance into this sea in latitude 43°. Coxe in his Carolana (1699) had said that he had discovered a west sea several thousand miles in circumference.

The second and third of these novelties the straits we have mentioned running N.N.E, were mapped out by Delisle from the descriptions contained in a printed account in English of a voyage by a Spanish admiral in 1640. This account had first been published in 1708, in a periodical called the *Monthly Miscellany, or Memoirs for the Curious.* Admiral De Fonte in this narration tells his own story: He narrates that in the year 1647 he sailed from Callao in Peru, accompanied by Capt. Bernardo in a second ship, under orders to intercept ships from Boston in N.E., which were in search of a north-west passage, and that at latitude 53°, Bernardo left time and traced the coast still farther north. Bernardo in latitude 61° ascended a river to 79°, whence one of his men went near to the head of Davis's strait and found there was no passage by water. When he rejoined De Fonte, the latter had returned from his extraordinary voyage through straits and lakes to the town of Conasset: where leaving his ship, and ascending a river near Hudson's bay, he came to a ship from Boston, Capt. Shapley, and conversed with him and its owner, Mr. Seymour Gibbons. This ship was trading for skins in a port of Hudson's bay.[1] The Admiral's conclusions were that there was no water communication to either of these bays, and he returned home with this report. This Boston ship must have left Boston within ten years from the founding of the Massachusetts colony. The names of Shapley and Gibbons were Boston names.

This alleged voyage of De Fonte in 1640 was so well accredited, that Dobbs made it the basis of an argument in 1744 to the British government for the certainty of a passage west through Hudson's bay: Ellis sustained it in 1748,

[1] This voyage from Boston is not the only one spoken of from independent authority; for at about the same period, (Ellis p. 71) Jeremie speaks of another ship's crew from Boston having been met with, whom some inferred might have been those spoken of by De Fonte.

and it was extensively believed in England up to 1776. Delisle's maps of 1750-55 were constructed on the theory of the voyage having been a reality. Lacroix in 1773 defends the truth of the account. As late as 1792, the Spaniards sent a ship to discover the Rio del Reys, the only authority for which was De Fonte's voyage.

While the credit which was given to this voyage of De Fonte by leading French and English geographers may astonish us, we must remember the intensity of interest by which it was stimulated, the desire to find a rapid passage to India by a northern route. On further investigations, pursued by a rival French geographer, Robert De Vaugondy and others,[1] it was pretty clearly established that although there were De Fontes or De Fuentes in Chili and Peru, yet there never was a Spanish or Portuguese admiral of the name of De Fonte, and that the records of Mexico and Spain contained no account of a similar voyage having ever been performed at any period. It was further established that there was no Spanish original manuscript, and that the account of the voyage in the English magazine of 1708 was a jeu d'esprit of the editor, Mr. Petiver, who was disposed to write a moon story on the most interesting theme of the day, i. e., the remaining undiscovered limits of the New World. And perhaps he hoped by showing from pretended Spanish sources almost the certainty of water communication from Hudson's bay to the Pacific, notwithstanding the Spaniards affirmed that there was no passage, to induce farther voyages to Hudson's bay for exploration.

The fourth of the geographical legends sustained by Delisle and Buache in their maps was the traditional straits

[1] Observations critiques sur les nouvelles découvertes de l'Admiral De La Fuente. Par M. Robert de Vangondy, fils., Geog. ordinaire du Roi. Paris, 1753. 12°.

of Anian. It was a strait believed to be a passage by the north from east to west, commencing in from fifty-five to sixty degrees of latitude. Cortereal had named it in the year 1500 : Ladrillero in 1504, M. Chack in 1579, and Maldonado in 1598, all pretended to have entered those straits. Maldonado says that he sailed through it and back again. De Fuca thought his straits were those of Anian. Viscayno had been sent in 1602 to discover them. Drake said that he had discovered them. Maldonado's account which was the most detailed turned out to be sheer invention. Even after Behring's straits had been discovered, (Alaska being supposed to be an island and our continent narrow on the north), the straits of Anian were still searched for : and it was inferred that Bernardo's or De Fonte's straits must be those of Anian. The discoveries of the Russians were supposed to confirm the statements of De Fonte. And even after the discoveries of Capt. Cook, and as late as 1791, the straits of Anian were sought for by the Spaniards under Malaspina.

Torquemada in his Monarquia Indiana (liv. v, cap. 45), says that Philip II of Spain had determined to discover the coasts of California, because certain foreigners had reported that they had passed by the north-west passage to the South sea by the straits of Anian, where they had seen a great town, and therefore Viscayno was sent on the enterprise.

The final conclusion must be, that although we have in Behring's straits, that which responds to the idea of a water communication to the Arctic ocean, yet that all the pretended straits of Anian, were delusions of navigators or inventions of others.

Ten years after Delisle, in 1765, only one hundred and five years since, Engel, the Swiss geographer, published a volume containing his studies on Western geography, accompanied

with maps, upon which were delineated his ideas of the mountains and rivers of the interior and of the coast.[1] He rejected the notion of the truth of De Fonte's voyage, of the sea of the west, and of De Fuca's strait, and preferred generally the data given in the Spanish maps of the earliest period. These, the Dutch and English geographers had, with good reason, little by little disregarded in their maps, or had given undue preference to the account of some one of the navigators. In accordance with his theory, Engel between 35 and 40° of latitude stretches our western coast through 25° of longitude to the west, instead of less than five, as is the real fact; and draws five rivers running due west to the Pacific from the interior, between 36 and 48° north latitude, one of them flowing over 50 degrees of longitude.

The results of Engel's studies, when compared with our present knowledge, show that as little value was to be attached to the Spanish maps as to his own speculations. They were all alike constructed from unreliable data as regards the north-west coast in almost every particular.

Maps published in London as late as 1775, (Sayer & Bennett's), adopt Engel's views in part, and a river is represented as flowing into the Pacific in latitude 45° due west, out of Lake Winnipeg. These maps trace sometimes an imaginary north-west coast, but only refer to De Fonte, De Fuca, Chinese or Japanese maps for their authority. Some maps of this date treat the coast as unknown north of 43°, and leave an absolute blank from that point.

We have thus followed the discoveries of the North West coast up to one hundred years since. And one hundred years since commenced the re-discovery by the Spaniards of Upper California. An ecclesiastico-military expe-

[1] Mémoires et Observations géographiques et critiques sur la situation des pays septentrionaux de l'Asie et de l'Amérique. Lausanne, 1765. 4to.

dition came by land from Lower California, and established itself at San Diego on the first day of July, 1769, making the first historic day for California. Monterey was re-discovered May 31, 1770, not having been seen since 1603 by Viscayno. San Francisco was re-discovered by land, in 1770, made a mission in 1775, and a presidio in 1776. The harbor was entered by water for the first time in 1775 (Randolph, p. 22, 33). These proceedings caused great rejoicings and ringing of bells in the city of Mexico, and at Madrid.

The final general outline of our North-West coast was not made till ninety years since, in Capt. Cook's great but fatal third voyage. From Drake's time to Cook, no English flag had gone north of 43°. Simultaneously with our revolutionary war, under instructions from the Admiralty to survey that coast for the purpose of finding a northern passage to the east, and to discover the limits of the continent, Cook left Plymouth in July, 1776, and reached lat. 44° 33′ in March, 1778. It is not impossible that the ideas prevalent during the twenty-five preceding years, both of the narrowness of the continent and of numerous channels and rivers from the west, led the British government to surmise that their rebellious colonists might with advantage be attacked from the rear as well as the front, or at least might be prevented from settling remote from her vengeance.

After Cook reached New Albion, the outline of the coast, as high as latitude 70°, was for the first time seen by a European, and surveyed with an accuracy that with the instruments of former navigators would not have been possible. "He effected more in a single season than the Spaniards had accomplished in two centuries, though he passed De Fuca's straits without seeing them." D'Urville, the French navigator, declares that he was the founder of

the true geography of the Pacific ocean: and to him we are indebted for the destruction of the geographical fictions so readily embraced by many preceding geographers.

While Cook was preparing for his voyage, the viceroy of New Spain sent out an expedition for the same purpose under Bruno Heceta, Juan de Ayala and Iuan de la Bodega y Quadra, in 1775. The account of this expedition was written by Maurelle the pilot of one of the vessels. Maurelle went as far north as 57°, and he obtained a tolerable outline of the coast to that point, and sent home a note of alarm regarding the progress of Russian settlement. Maurelle had no better charts than the conjectural ones of the French, such as Bellin's of 1766, and he was on the look out for DeFonte's pretended straits, which were in full faith still retained upon those charts. In 1779, another Spanish expedition, accompanied also by Maurelle, and De la Bodega y Quadra, was sent over the same track, apparently unconscious that Cook had preceded them during 1778. This voyage went no farther north than 59°. . In 1774 and 1755, Perez and Martinez, under the Spanish flag, anchored at Nootka sound and sailed as far as 58°.

The discoveries of Capt. Cook were not published until 1784. They produced a great excitement in favor of free trade in furs, hitherto a monopoly of fur companies; and the rivalry for this trade led to numerous voyages of ships of all nations. The most prominent of these were those of Portlock and Dixon in 1786 and 1787, chiefly for the purpose of trading in furs: when a détour for discovery was made, it was for the sake of finding new regions to buy furs of the natives. Dixon chronicles our still existing ignorance of the continent by the observation, that "so imperfectly do we know the coast that it is in some measure to be doubted whether we have yet seen the main land; whether any land we have been near is really the

continent, remains to be determined by future navigators." But he adds "the fur trade is inexhaustible."

Meares, a mercantile voyager, in 1786, was the first European who had wintered on the coast north of San Francisco, making it an event of historic importance. He was a believer in De Fonte's and De Fuca's voyages as authentic.

The next discoverer was, as was proper, an American, sailing under ship's papers given by the old Confederation in 1787. Capt. Gray, of Boston, on his second voyage, discovered the Columbia river, in 1792, and by right of discovery, then the law of nations, secured that outlet on the coast to the United States. He discovered Bulfinch's harbor, the only one for seven hundred miles, discovered Queen Charlotte's to be an island, and revealed De Fuca's straits to Vancouver, and for the first time carried the United States flag around the world. La Perouse had discovered the archipelago of Queen Charlotte's in 1786.

Notwithstanding the discoveries of Capts. Cook and Gray, the results of the fabulous voyages of De Fonte, De Fuca and others were retained on maps till within eighty years, and they were not overthrown, and the veritable continent defined in its western limits until the memorable voyage of Vancouver was completed in 1794.

Vancouver met with Capt. Gray on the coast to the great surprise of the former, and profited by the communications made to him. He surveyed and defined Vancouver's island and its archipelago, and visited in all nine thousand miles of coast.

It was only after the results of his discoveries were published that it could be said that we had a tolerably correct map of the north-west coast. And yet absurd as it may seem, as late as 1794, Vancouver was in the hope, according to his instructions, of finding a river by

which he could reach the Lake of the Woods, which is in latitude 49° and longitude 95°, and writes of it as an important fact he had substantiated that there was no naviable passage to the east from latitude 30° to 56°. Capt. Hendrick, an American, in 1789 went around Vancouver's island.

While it is within eighty years since we have learned what is the coast outline of our continent, it is not till within a period less than half of that, that we have become acquainted with the outlines of its interior geography. The continent a hundred years since had never been traversed by a European, north of Mexico; nor in Mexico, north of the gulf of California. Delisle's map of 1785 has in an immense blank space the record: "the whole interior is unknown."

The plan of Jonathan Carver of Connecticut for crossing from ocean to ocean in 1772 had failed. His scheme was to have a military post established at the straits of Anian near Oregon. His map of 1778 contains a delineation of the sea of the west, the straits of Anian and of De Fuca, now fables of the past.

John Ledyard, also of Connecticut, in 1786, persevered in a scheme, in which he was aided by Jefferson, to traverse the American continent by entering it from Russia; but was hindered from accomplishing it, owing to his imprisonment by the Russians.

Samuel Hearne of London, in 1772, by his journey of thirteen hundred miles from Fort Prince of Wales in latitude 60° to the Coppermine river, established the fact that the continent did not extend to the North pole.

Alexander McKenzie in his first journey westward in 1789, reached only the Arctic ocean, but farther west than Hearne, to the river still called after his name as discoverer. In his second journey in 1793, he was the first

European to cross the continent on the north, and in its broadest part, latitude 52° 20′. He had started also from the same fort on Hudson's bay, from which Hearne had proceeded. The British had no trading or military posts west of the Rocky mountains previous to the year 1806.

A map of Mexico of Humboldt's, bearing date of the year 1811, designates the whole of the western territory of the United States as "unknown."

In concluding this representation of our ignorance of California and the north-west coast until a comparatively very recent period, I will simply enumerate very briefly the prominent American exploring tours of the present century, by means of which this ignorance has been removed, and the country opened for settlement.

It was not until 1804, the continuous chain of the Rocky mountains being as yet untraversed, and it still being possible that an inland sea existed larger than Lake Superior, that the continent was traversed by explorers through the territory of the United States. The expedition of our government, for which so much credit is due to Jefferson, was commanded by Lewis and Clark, and went down the Columbia river to its mouth. Their full narrative was not published till 1814, and down to 1844 was the principal source of information regarding the interior.

Major Zebulon Pike's expedition in 1805 to 1807, was to find the sources of the Mississippi, and of the Arkansas, Kansas and Platte rivers.

Hunt's expedition of 1811 was to found the settlement of Astoria at the mouth of the Columbia river. This settlement was shortly after abandoned by the American interest, owing to the war with Great Britain.

Major S. H. Long's expedition in 1819 and 1820, was up the Platte to the Rocky mountains, and back by way of the Arkansas river.

Schoolcraft and Cass's expeditions in 1820 and 1832, were for the discovery of the sources of the Mississippi, and to visit the copper deposits of Lake Superior.

Fremont's expedition to Oregon and California, in 1843 and 1844, made a virtual discovery of Great Salt lake, of the basin of California, and established that there was no principal river flowing into the Pacific besides the Columbia.

The magnificent series of explorations of the United States government for a Pacific rail road route across the continent, on eight parallels of latitude, were as late as 1853 and 1854.

No permanent settlements were made by us west of the Rocky mountains previous to 1834, being those which were commenced in Oregon.

It was in 1827, that the first American entered California across the continent. He was an agent of the American Fur Company by the name of Jedidiah S. Smith. Finding himself in want, he resorted to misrepresentation, so as to secure protection and food from the jealous Spanish settlers. He and his party of forty men were already gold hunters rather than fur hunters.[1]

The future of California, its wealth, population and prosperity, either under Spaniards or Americans, was as yet anticipated or prophesied by no one. Two years before the discovery of gold, a writer in the *Southern Quarterly Review*,[2] predicts for her a future of the greatest inferiority. "Whether California will ever become of any great importance in the history of the world, or advance to any conspicuous position, agriculturally, commercially, or politically, is susceptible of the greatest doubt. In itself, it

[1] E. Randolph's Address, 1860, San Francisco.
[2] Vol. VIII, 1845.

has little prospect beyond a nerveless imbecility." Such were the prevailing anticipations only twenty-five years since, regarding the destiny of the countries on the shores of the Pacific.

It will always be a theme for wonder that by the progress of the arts and sciences within this one hundred years, the shortest route from Europe to China and Japan, to Cathay and India, has been found not in a passage by sea to the north of the continent, but by means of steam-cars on an iron road, through the territory of a people, not then having an independent existence, and now having more than five millions of inhabitants west of the Mississippi.

PROCEEDINGS OF THE ALBANY INSTITUTE.

[Continued from Transactions Vol. IV.]

December 2d, 1863.

The Institute met pursuant to call, the president, Mr. Pruyn, in the chair. Present, twelve members and a few visitors.

Dr. F. B. Hough was appointed secretary for the evening.

The president read a letter from Prof. Murray, secretary of the Institute, in which it was stated, that in consequence of removal from the city he was under the necessity of resigning the office of secretary which he had held for several years.

Dr. Howard Townsend presented the following resolutions, which were unanimously adopted, and ordered to be entered upon the journal of the Institute and a copy to be transmitted to Prof. Murray:

Resolved, That whilst congratulating Prof. David Murray upon the honor lately conferred upon him in his appointment to a Professorship in Rutgers College, New Jersey, we must at the same time express our regret at the loss with which our Institute meets in his acceptance of his appointment.

Prof. Murray's services, during the long period he has been connected with the Institute as member and secretary, have been of such great value that their cessation must necessarily prove a loss. And in order that Prof. Murray's connection with the Institute should not entirely cease, it is suggested that he now be appointed a corresponding member of the Albany Institute.

Professor David Murray was thereupon elected a corresponding member of the Institute.

The following persons were nominated as resident members: Prof. James Weir Mason, of the Albany Academy, by Mr. Pruyn; Jacob S. Mosher, of the Albany Academy, by Dr. Townsend; Col. Lockwood L. Doty, Chief of the Bureau of Military Statistics, by Dr. Hough.

The rule as to nominations being suspended by unanimous consent, these gentlemen were duly elected resident members.

Dr. J. S. Mosher was appointed secretary *pro tem.*, until the annual election of officers in January next.

December 15th, 1863.

The president, Mr. Pruyn, in the chair. Present, nineteen members, and several gentlemen not members.

Dr. Howard Townsend read a paper upon the discovery and publication of the ancient manuscript known as the "Sinai Bible" or "Bibliorum Codex Sinaiticus." This manuscript accidentally came to the knowledge of Dr. Tischendorf, the well known biblical antiquarian, about four years since, while making researches, under the patronage of the Czar, for Greek and Oriental manuscripts, and especially such as might be serviceable in promoting biblical and ecclesiastical learning. At the convent on Mount Sinai, in possession of the steward, he found, by mere chance, a large quarto volume written upon vellum, and consisting of 345½ skins, of which 199 belonged to the Old Testament and the remainder to the New. On every page there were four narrow and regular columns written in Greek uncials, and supposed to date back to a period certainly as old as the Vatican Codex, which is attributed to the middle of the fourth century. Although mutilated, the manuscript contains the New Testament complete.

Dr. Tischendorf succeeded in obtaining the original, which in October, 1859, he placed in the hands of the Czar. Its great value being at once appreciated, the emperor ordered it to be printed in fac-simile for distribution among public libraries.

Dr. Townsend exhibited a copy, in common Greek type, of the New Testament portion, and also copies of the Alexandrian and Vatican Codices, giving a concise account of the origin, custody, and publication of these venerable manuscripts, the first of which is in the British Museum, and the latter in the Vatican Library at Rome. He also laid before the Institute an ancient manuscript belonging to his library, an illuminated volume illustrating palaeographic subjects, and some specimens of parchment paper prepared by a chemical process, and closely resembling true vellum.

The thanks of the Institute were voted to Dr. Townsend for his able and interesting paper.

A committee, consisting of Mr. Hough, Mr. Munsell and Dr. Mosher, was appointed to make examination of certain packages of the Transactions of the Institute in sheets, and to report such action as might be thought advisable concerning them.

Upon motion of Dr. Townsend, the committee of publication was authorized to exercise a censorship of the published proceedings of the Institute, with the view of preventing errors in the insertion of matter not properly within their province for publication.

Mr. Eugene Van Rensselaer was proposed and elected a resident member of the Institute.

Prof. Hall called the attention of the members present to the report on the condition of the State Cabinet now first printed, in the appendix of which he had figured and described ten new species of fossil plants of the genus *Dictyophyton*. He made some remarks on the habits of the

marine algæ to which the genus belongs, and observed that the hollow stems had been mistaken for fossil shells.

Adjourned.

December 29th, 1863.

The president, Mr. Pruyn, in the chair. Present, eleven resident members, a corresponding member and two visitors.

Dr. Howard Townsend proposed Mr. Edward E. Burnett as resident member. The rule for the election of members being suspended, Mr. Burnett was elected resident member of the Institute.

Prof. Hall called the attention of the Institute to some fossils from the Potsdam sandstone, and made remarks as to the localities and depth of that rock in various parts of the United States and Canada.

January 13th, 1864.

Present ten members and three visitors. In the absence of the president, Dr. F. B. Hough presided.

The library committee, appointed at the regular meeting of the Institute held Dec. 15, reported: That they have found the signatures to complete the fourth volume of the Transactions, and that nothing remains to delay the early issue of this volume. They find a large number of imperfect sets of vol. I, and vol. II, and about 30 copies in sheets of vol. III, apparently perfect. In the course of their labors they also met with 48 copies of vol. I, half bound, 12 of vol. II, and 73 of vol. III, in paper covers. The library has also a large number of duplicate bound volumes of the Transactions of the Society of Arts from 1801 to 1819, and 55 copies of vol. II, of the first edition of the *Federalist*. It would be very desirable if by chance an equal number of copies of the first volume of this masterly work could be found, and thus the series completed. They also find a large number of duplicate

reports and other documents of the state and general governments.

The committee would recommend that the copies of Transactions of the Institute now in sheets be sent to some proper office to be gathered up and sewed, with paper covers, and that all that prove imperfect be sold for paper stock. They also recommend that authority be given carefully to examine the duplicate documents that remain unbound in the library of the Institute, and that those which are deemed to be not available for exchanges be also sold.

It is suggested that an inquiry made among the scientific and literary societies in correspondence with ours, might result in a mutually advantageous exchange of many of the duplicate volumes of reports above mentioned.

It is also recommended that measures be taken for arranging and binding the pamphlets and publications received from other societies as donations. If the expense of binding be considered too great for the present funds of the Institute, they should at least be carefully gathered, collated and tied in packages until a convenient time for binding.

The recommendation of the committee was adopted.

A resolution was offered that a committee be appointed by the chair to examine the duplicate documents in the library of the Institute, and to prepare and issue a circular to societies in correspondence, with the view of effecting exchanges of such as may be available. This committee shall have power, and is hereby directed, to dispose of imperfect sets of sheets and other duplicate matter deemed unavailable, and to pay the proceeds of such sales into the hands of the treasurer.

Mr. Burnett then read an elaborate paper on the Study of Language. The object of this paper was to show the advantages to be derived from a thorough acquaintance

with the interchangeability and convertibility of letters as a means of etymological research, and as a means of systematically acquiring the English and the Romance languages from a comparison with the Latin, Greek, and Sanscrit: also, to show the manner in which the differences of voice, mood, tense, number and person of the verb are generated by means of pronominal affixes, prefixes and augments, showing the common origin of the pronouns in different languages. He also explained how certain tenses of the verb are formed in the Italian, French, Spanish, and Portuguese languages, from a combination of other tenses with the infinitive. This theory explains the law of formation that governs the past tense of the regular verb in English, and he pointed out the effect of certain combinations of the labial, lingual, and guttural elements with the element of motion to express the different *varieties* of action. He applied some of these principles to the discussion of the genesis of the word *as* AS, and, from a comparison of its use in English with its use in Sanscrit, Greek, and Latin, to make evident its pronominal nature.

Mr. Burnet remarked that the length of time allotted to such a paper would forbid a thorough exposition of the variety of matters touched upon, and the best that could be done was to foreshadow certain general principles that a future paper will more fully embody and elucidate.

Adjourned.

January 26th, 1864.

Seventeen members present. In the absence of the president, on motion of Dr. Hough, Mr. Carpenter took the chair.

The treasurer's report of receipts and expenditures for 1863 was received and referred to the usual committee. The chair appointed as such committee: Mr. Munsell, Dr. Willard.

The resolution to appoint a committee to examine and make disposition of the unbound sheets, magazines and duplicate volumes belonging to the library, which was laid on the table at the last meeting, was called up and adopted. The following were appointed as such committee: Messrs. F. B. Hough, Munsell, Willard, Mosher.

The Institute then proceeded to the election of officers for the ensuing year, and the following persons were unanimously elected:

JOHN V. L. PRUYN, President.
ANDREW E. BROWN, Treasurer.

First Department —
RICHARD V. DEWITT, President.
JOHN PATERSON, Cor. Secretary.
JACOB S. MOSHER, Rec. Secretary.
GEORGE W. HOUGH, Librarian.

Second Department —
STEPHEN VAN RENSSELAER, President.
PETER GANSEVOORT, Vice President.
S. OAKLEY VANDERPOEL, Rec. Secretary.
JOEL MUNSELL, Cor. Secretary.
CHARLES B. REDFIELD, Treasurer.

Third Department —
ALEXANDER S. JOHNSON, President.
JOHN N. CAMPBELL, Vice President.
JACOB I. WERNER, Cor. Secretary.

Curators — JAMES HALL, HOWARD TOWNSEND, CHARLES H. ANTHONY, AMOS DEAN, ANDREW E. BROWN.

An interesting paper was read by Dr. F. B. Hough on the Battle of Cedar Mountain, being an extract from his forthcoming work, *The History of Duryea's Brigade*, now in preparation.

Mr. Munsell moved that a copy of vol. II of the Transactions be presented to Dr. James Eights, one of the old

members and contributors to the Institute, who was present, which was agreed to.

Adjourned.

February 10th, 1864.

Ten members present. In the absence of the president, on motion of Dr. Hough, Dr. Vanderpoel took the chair.

Prof. G. W. Hough presented an account of a series of experiments with which he has been engaged during the last year, in reference to the compensation of pendulums for changes in temperature.

Prof. Hough prefaced his account with some general remarks on the various kinds of pendulums.

Wooden pendulum rods expand one-fifth as much as steel, and steel expands $\frac{1}{5}\frac{1}{3}\frac{1}{3}$ of its length, for a change of 180° in the temperature. In the mercural pendulum, the expansion of the mercury varies the point of oscillation as much as the expansion of the rod lowers it. Mercury expands $\frac{1}{5}\frac{1}{5}$ of its length at the same time that steel expands $\frac{1}{5}\frac{1}{3}\frac{1}{3}$, and the length of the column of mercury is to the length of the rod as 55 : 833. So much having been determined by calculation, the pendulum is compared with another, and they are closely watched to see if their vibrations are alike. If the pendulum thus prepared vibrates too rapidly, the point of oscillation is too high and some of the mercury must be taken out—if too slow more mercury is to be added. The amount of mercury cannot be accurately computed beforehand.

Prof. Hough has made use of a new method of compensating, by which it can be done to a greater degree of accuracy than by any process previously used. This method of compensating a pendulum is another application of electricity in connection with a chronograph. By it we are enabled to know from second to second and minute to minute exactly how our pendulum is performing. We are able to determine the rate of the pendulum for

every degree of temperature lying between the two extremes. In case the pendulum moves with an uniformly accelerated velocity in the process of heating, the chronograph record will exhibit a curve bending towards the left. By means of an angular micrometer, the difference between the rates of the two pendulums down to the hundredth of a second may be measured.

By this method, the compensation of any pendulum becomes an easy matter and susceptible of very accurate results. After having computed the amount of mercury necessary, the oscillations of an experimental pendulum are recorded in the chronograph for half an hour or more, when comparing it with the standard pendulum which is also recorded at the same time, and the difference of rate between the two pendulums is determined. On subjecting our experimental pendulum to a higher temperature and again making the record, any change of rate is immediately detected. Having determined the amount of this change, any convenient amount of mercury may be added or subtracted, and repeating the same process, the effect of the amount of mercury in compensating may be found. Now without going into a rigid mathematical discussion to determine what amount of mercury should be added or subtracted, the simple proportional part corresponding to the change of rate may be taken. In case a pendulum is nearly compensated at the start, two repetitions of this process will give an excellent pendulum.

Prof. Hough mentioned some other influences which disturb the regular vibrations of the pendulum, among which is the effect of the attraction of the moon, which acts in two ways to affect the vibrations, by modifying the influence of the earth's attraction.

Changes in the atmosphere, giving at different times a medium of varying density to resist the motion of the pendulum, were also mentioned. The amount of this varia-

tion has never been computed, but it is of considerable importance.

The difference of temperature in the top and bottom of the room is also a cause of disturbance, as it affects the rod of the pendulum, and does not compensate by expanding the mercury. He stated that it had been supposed that pendulums require some time after being disturbed before they regain their regular vibrations. He has determined by accurate experiments with the chronograph, that they will begin to vibrate regularly in about twenty minutes.

Prof. Hough made some remarks during the discussion that followed, upon the subject of personal equation; and announced a future paper on that subject.

The personal equation of the eye may be divided into two classes. First: The recording of an instantaneous phenomenon, as the sudden appearance of a meteor, and Second: the recording of the transit of a star across the wires of the telescope.

In the first case, there is but little variation between different persons, the average time for the mind and muscles to act being about 0.14 of a second.

In the second case, there is a wide range between different persons, the *difference* amounting in some instances to nearly half a second of time.

It has been supposed by some, that this error of observing might be removed by cultivation, but investigations thus far go to show, that in attempting to do this we introduce other errors of greater magnitude and uncertainty than those we propose to remove.

Dr. Willard offered the following report:

The undersigned who were appointed a committee to examine the treasurer's account, beg leave to report that they have compared the vouchers with the statement of the treasurer, that they find his report correct and that

there is now a balance in the hands of the treasurer amounting to $229.17. All of which is respectfully submitted:

JOEL MUNSELL,
S. D. WILLARD.

Report accepted and committee discharged.

Dr. Willard announced that Dr. John H. Griscom, of New York, whose name is so prominently identified with sanitary reforms in cities, was present, and Dr. Griscom, upon the cordial invitation of the chairman, then addressed the Institute on the subject of the sanitary reforms needed in New York.

Mr. Munsell nominated Joseph W. Russell, as resident member. Dr. Hough nominated Dr. John H. Griscom, as corresponding member. The rules being suspended, Dr. Griscom was elected corresponding member of the Institute.

Dr. Vanderpoel presented the matter of employing a suitable person to examine and put in order the Museum of the Institute, if in want of such repairs. On motion the following were appointed a committee to examine into the condition of the Museum and report: Mr. Brown, Mr. Munsell, Dr. Mosher.

On motion of Prof. Mason, such of the curiosities in the Museum as could be safely used for that purpose were offered for exhibition at the fair now in preparation in aid of the Sanitary commission.

Adjourned.

February 23d, 1864.

Present, the president, and ten other members.

Dr. F. B. Hough from the library committee, reported that the committee had in the performance of the duty assigned them, found some useless and much valuable unbound material in the library, and asked for instructions as to its disposal. On motion of G. W. Hough, the committee

were authorized to have bound such unbound sheets and magazines as are of value.

Joseph W. Russell, nominated at the last regular meeting, was elected a resident member of the Institute.

Dr. Willard read a paper by his friend, Dr. Oliver White, of the New York Academy of Medicine, which on account of its interest and novelty he thought proper to present to the Institute. It was entitled Impalement of the Vagina, illustrated by cases. In one case, the impalement was upon the handle of a brush or broom, which entered the body for ten or twelve inches; the other case was that of a woman sliding from a mow of hay, down the end of a pitchfork handle which lay concealed in the hay below. The walls of the vagina were ruptured, and the fork handle passed into the bowels. A third case was somewhat similar: only one of these cases happened within the observation of Dr. White.

Dr. Willard also read a paper by Dr. Samuel R. Percy, entitled, The Food of our Cities, which was a full expose of the impurities in the production and adulteration of milk in the city of New York.

Adjourned.

March 9th, 1864.

In the absence of the president, on motion, Prof. Mason took the chair.

Mr. Brown nominated William J. White. The rules being suspended, the Institute proceeded to vote on the nomination, and Mr. White was elected a resident member.

Mr. Munsell announced that the fourth volume of Transactions of the Institute, which had been ordered printed, was now ready, some copies of the volume being upon the table.

March 22d, 1864.

Sixteen members present. On motion of Mr. Brown, Dr. Howard Townsend took the chair.

Mr. Brown nominated Leicester Allen for membership. The rules being suspended Mr. Allen was elected resident member of the Institute.

Prof. Anthony, in accordance with previous announcement, gave an account of the late Prof. Amos Eaton, with reminiscences of him, as connected with the Rensselaer Institute. The building occupied by the Institute is a double house standing about half way between Troy and Lansingburgh, near the west end of the state dam, and was originally erected to answer the purpose of a bank common to both these places. The Rensselaer Institute was originally established by General Van Rensselaer, the father of the present Patroon. The course of instruction occupied about a year, and was in the form of lectures. The Institute was authorized to grant the usual collegiate degree, A.B., on graduation, and A.M., three years after. Over the Institute, Prof. Eaton presided, assisted by professors. Among the students in attendance at the time when Prof. Anthony entered, were two brothers of Wm. C. Bryant, and the Hon. George W. Clinton, now of Buffalo. The classes, which went to the rooms of the different professors at nine in the morning, numbered from four to six students each, and at twelve o'clock all met in the library for mutual criticism.

One room of the building was occupied by Prof. Eaton, and in it all of his works were written. Prof. Anthony gave an account of his family, and paid a fine tribute to his kindly qualities, which it was now a pleasure to recall, as well as to make record of many acts of kindness received from him.

One of the means of amusement among the students was reading. We spent one evening till late in the night listening to our best reader, George W. Clinton, who read Byron's Corsair. The next morning it was announced that Gov. De Witt Clinton had died the night before, and

George had left, having heard of it just as he was about to retire.

Prof. Anthony mentioned an amusing incident which occurred to two of the professors of the Institute, who while on a mineralogical expedition, chipping some specimens from the high rock at Saratoga, were set upon as vandals by an officer and his *posse*. One who was light escaped by running, while the other who was too heavy thus to succeed, managed to become mixed up with the pursuers and assisted them in their shouts of "stop him," and efforts to make a capture.

Prof. Anthony paid a warm tribute to the usefulness of the Rensselaer Institute, now devoted especially to civil engineering.

Dr. Willard stated that he had in course of preparation a volume consisting of biographical memoirs of the deceased members of the Medical Society of the County of Albany, from 1806. He read a sketch of Dr. Wilhelmus Mancius, whose name was first on the list. The original members of the society were: Wilhelmus Mancius, Hunloke Woodruff, William McClelland, John G. Knauff, Caleb Gauff, Augustus Harris, Joseph W. Hegeman, Cornelius Vrooman, Jr., Alexander G. Fonda, Charles G. Townsend and Elias Willard. Dr. Mancius was the son of a Dutch clergyman, and was born in Ulster county, in 1738. He practiced his profession for many years in Albany, and died in 1808, at the age of seventy.

The second sketch was that of Dr. Hunloke Woodruff, who was born in New Jersey, in 1755. He was an accomplished scholar, gentleman and physician, and served as surgeon in the Third New York regiment, commanded by Col. Peter Gansevoort of Albany, during the revolutionary war. After the war, he resided in Albany, where he was a leading surgeon. He died in 1811, at the age of fifty-six years.

After the usual recess for refreshment, Mr. Bogart spoke of Ezra Ames the artist, of whom he was reminded by some of the incidents mentioned in Dr. Willard's paper, as a remarkable man and a skillful artist. After some further remarks, on motion of Dr. Willard, Mr. Bogart was invited to prepare for and present to the Institute, a sketch of the life of Mr. Ames, with an account of his historic paintings.

Mr. Munsell moved that a copy of the fourth volume of the Transactions of the Institute be presented to each of the members. Adopted.

On motion, the secretary was directed to place presentation cards in the volumes of the Transactions which were donated.

Adjourned.

April 5th, 1864.

Seventeen members and a few visitors present. In the absence of the president, on motion of Mr. Munsell, Dr. Howard Townsend took the chair.

Prof. George W. Hough presented an account of the Swedish Tabulating Machine of Mr. George Scheûtz.

This machine, which bears the impression " Stockholm, 1853," is the only one of the kind that has ever been constructed. It is a well known fact that Mr. Charles E. Babbage was the first to attempt the construction of a Difference machine, but owing to some misunderstanding between the inventor and the English government, under whose patronage the machine was being built, it was never completed.

About the year 1834 or 1836, Mr. Scheûtz, a printer at Stockholm, heard of Mr. Babbage's machine through the public prints, and at once conceived the idea of building one himself. After years of trial and difficulty, he finally succeeded in producing the machine in question, which, we

may remark, is totally different from the one contemplated by Mr. Babbage.

The Scheûtz engine was put in operation at the Dudley Observatory for a short time, in the year 1858, but since that time it has not been in working order. When we undertook the study of it, a short time since, it was found to be so much out of repair and in such a state of confusion, that it seemed almost impossible to discover the mechanical principles on which it was based; but from the study of its details, in a few days the theory of the mechanism was revealed, after which it was an easy matter to restore the whole theory of the machine for making any class of computations comprised within its limits.

Prof. Hough then proceeded to explain the principle upon which the mechanism is arranged. Its fundamental principle is based on the mathematical truth, that in any series of numbers the *ninth* order of difference will be zero, when n may be any number whatever. This machine is constructed for four orders of differences, and will consequently compute any series in which the fourth orders of differences are equal.

The manner in which the differences were marked by the various wheels, was illustrated by a specimen brought from the machine and by diagrams on the board, after which some particulars were given of the action of the machine. It may be used to fifteen places of figures, of which eight places are printed at the time of making the calculation. Thirty seconds is the time necessary for a complete result.

Before starting the machine for any computation, it is necessary to set the appropriate wheels, after which it needs no further attention; for so long as the last order of differences is constant, it will continue to produce the required numbers. Thus, for producing a table of squares it is only necessary to give the machine three numbers 1, 3,

and 2, and from this data we can compute the squares of all numbers up to 30 millions. In the same manner, by giving the machine the numbers 1, 7, 6, 6, we can produce a table of cubes, the limit being 15 figures.

The same principles apply in the computations of Logarithyms, or any series of numbers whatever.

Prof. Hough closed by giving an invitation to the members of the Institute to call and examine the machine, which is now in operation at the Dudley Observatory, and exhibited specimens of its work printed on both paper and plates of lead.

Dr. S. D. Willard read a brief biographical notice of Dr. Elias Willard, a former member of the Institute.

Elias Willard was born in Harvard, Mass., on the 17th of January, 1756. He was present at the battle of Bunker Hill, and served during the war of the revolution, either as regimental or hospital surgeon; subsequently, he settled in Saratoga county, and in 1801 in Albany, where he died March 20, 1827, at the age of seventy-one years. He was a man of marked piety and patriotism.

Dr. Willard also read a biographical notice of Dr. Lewis C. Beck, contributed for his work by Mrs. Pierre Van Cortlandt, the surviving daughter of Dr. T. Romeyn Beck.

Lewis C. Beck was the youngest brother of Drs. T. Romeyn Beck and John C. Beck, and was born in Schenectady, October 4, 1798. He was largely instrumental, with his brother, in the organization of the Albany Institute, in the transactions of which are several of his valuable papers. He filled professorships in several colleges, the last being at Rutgers College, New Jersey, and the Albany Medical College. He was the author of several medical works, and of many scientific articles; an indus-

trious, upright, good man. He died in Albany, April 20, 1853, in the fifty-fifth year of his age.

Adjourned.

April 19, 1864.

Fourteen members present. In the absence of the president, on motion of Mr. Munsell, Mr. Redfield took the chair.

Dr. Willard read a biographical notice of Dr. Jonathan Eights. Dr. Eights was of Holland extraction. His grandfather was William Eights of Amsterdam, and his grandmother, Mary Van Dyck, of Rotterdam. His father was Abraham Eights, a prominent citizen of Albany. Jonathan was born in Albany, November 26, 1773; studied medicine with Drs. Mancius and Woodruff; was licensed April, 1797. He practiced until 1810, in Montgomery county, and then removed to Albany, where he continued the rest of his life. Dr. Eights was an associate contributor to the Medical and Physical Journal in New York: president of the Albany County Medical Society in 1814–15–16, and in 1841: president of the Medical Society of the State of New York, in 1830 or 1831. He was well versed in medical literature, and diligent in his profession. He died August 10, 1848, in the seventy-fifth year of his age, having been in professional life fifty-three years.

Dr. Willard also read a biographical notice of Dr. Joel A. Wing, a former member of the Institute.

Joel A. Wing was born in Berkshire county, Mass., August 13, 1778. He was a licentiate from the Montgomery County Medical Society, and subsequently attended medical lectures at the college of Physicians and Surgeons in New York.

He was a post-surgeon at the barracks opposite Albany, in 1814: president of the County Medical Society in 1826 and 1827: received the degree of doctor in medicine

from Williams College in 1825: president of the medical Society of the State of New York in 1843, and for several years a manager in the State Lunatic Asylum at Utica.

Dr. Wing spent thirty-eight of the forty-one years of his professional life in Albany. He read much, and his memory was accurate and retentive. His business habits were extremely laborious and methodical. In social life he was gay and buoyant, and his fund of anecdote and information almost exhaustless. He was a skillful physician, and a model of propriety and kindness towards his patients. He was popular in the profession throughout the state.

He died in Hartford, Connecticut, on the sixth of September, 1862, in the sixth-fifth year of his age. His oldest son, Matthew Gregory Wing, a graduate of Yale College in 1847, on account of ill health resided in the south of Europe several years, and finally died at Santa Fe, New Mexico, on the fifth of July, 1860, at the age of thirty-four years.

Adjourned.

May 3d, 1864.

Seventeen members present. On motion of Dr. Howard Townsend, Mr. A. E. Brown, in the absence of the president, took the chair.

The Rev. A. S. Twombly, according to previous announcement, read the paper of the evening on the subject of Oriental Oddities. Mr. Twombly said that he intended no harm to Abraham, Isaac and Jacob, in these caricatures of their descendants, any more than the eagle meant disrespect to the mother owl in swallowing her progeny, a scrawny set, so unlike her description of them; for the men of the east retained the costumes, manners, and memories of patriarchal days, yet in comparison with modern customs and ideas they are degenerate and utterly unworthy of their origin.

The Orientals are at the antipodes of western culture, grasping all ideas at the wrong end, as Arabs seize their horses' tails and swing themselves into the saddle. Their women therefore are of necessity degraded, their sons applying the rod sometimes in strange reversal of King Solomon's suggestion, making it "spare the rod if you would spoil your mother."

Their animals likewise partake of the rude and uncivilized condition of things, wearing their tails of ten or a dozen pounds in weight.

The praying Mussulmans differ from men of western churches, in being proud of their prayers and praying everywhere and at all times, thus giving rise to the Moslem proverb: "If your neighbor prays one time a day, avoid him; if twice, let him alone; if three times, move into another street."

The maidenhood of Oriental women is passed in balancing water jars, gossiping, and wearing all their dowry on their heads; occasionally interrupted by coy flirtations with Howadjis strolling through the land.

The Arabs of the Jordan and Dead sea remind one of Sir Walter Scott's tales of crusading times, and are every whit as nimble, thievish and intelligent as their Arab steeds. The Dead sea (all former chronicles to the contrary notwithstanding) will allow a man to drown if he has a mind to. If one bathes in it, however, his ears are salt cellars; his eyes, a sea of briny fire; all abrasions of his flesh a perfect Sodom and Gomorrah to his feelings; and if the water chances to get into him in any quantity, the result is better fancied than described.

The doctors of the east were humorously alluded to by Mr. Twombly, as enjoying a lucrative profession, and not like the hakims of the Hindoos, obliged to take their own doses, and to die with any of their patients whom they overdose; but, giving simple remedies according to the

days of the week, their patients, not themselves, are responsible for all results. The Turkish bath, is, however, the usual sanitary method ; a steamy, joint-cracking, happy operation, not unlike the boiling, peeling process of potatoes in a pot, but landing the recipient of hydropathic favors in a heaven of delicious poetry and flowers, where he must exclaim with every son of Islam, "Water is indeed Great Allah's gift."

The camel is found to belie all school geographies and works on natural history, by exhibiting the most growling snarling nature possible, but a ride upon his humps proves swift and joyous as upon the wings of wind.

Mr. Twombly gave some amusing instances of the gullibility of the Orientals, as illustrated by their reception of such stories as the rabbis tell of Og, the King of Bashan, whose shin bone was higher than a palm tree and out of whose molars Abraham made a bed for his own accommodations! The tomb of Jonah also they confidently believe to be upon the spot where he once more saw light, when the dyspetic whale disgorged him as too indigestible for the ordinary stomach of the catodontidæ.

Arab education makes these stories more digestible mentally than the prophet physically, for on visiting a school and throwing some piasters among the attentive pupils, all the arrangements of the school were thoroughly disturbed *except* the school master, who offered the self-constituted committee his dirty pipe, and thought his scholars had obtained a new idea.

* * It was apparent also that the gentle Moabitess (of whom Hood has written such a sweet sonnet) would not recognize the mothers of these boys as in the same sense her people, as was Israel of former days, much less would their God be her God, since all they seem to think of is the coins in their hair, the pipes that coil their

snaky folds up to their lips, and their liege lords who keep them in the utmost ignorance of any other gods.

The palm tree of the east is its apt and most striking emblem, giving from a cluster no deep shade, but letting sunshine fall diffusedly and cheerily on those below. These trees, more than all other relics of the past, live in the traveler's memory; for, like the story of the sultan, whom his slaves propped up in death to receive the plaudits of his people, there is a cry, "Long live the East," but its life, except in natural objects, is gone.

To go by railroad from old Joppa to Jerusalem will perfect the outrage on the past, and to telegraph from Mamre, where Abraham entertained the angels, will almost rouse that ancient worthy from his sepulchre; yet all these things must come. "The arches of the grand old viaduct of history (through which the streams of oriental life and minstrelsy have flowed to us) already crumble over the traveler's head; soon none can count their stones. The sand will cover them and no trace remain. Let, then, the few scenes such as we have pictured, link the scientific present to the dreamy past. Let these few relics of old patriarchal times, yet to be seen in oriental lands, at least secure belief in that grand record of the early eras on which our faith, our hope and destiny depend."

Adjourned.

May 24, 1864.

Ten members present. On motion, Mr. Munsell occupied the chair.

Prof. G. W. Hough, of the Dudley Observatory, announced that he had intended to read a paper to the Institute on the subject of Personal Equation, but his investigations on that subject being yet incomplete, it would be deferred to a future meeting.

Prof. Hough called the attention of the members to an *alleged* discovery of a new planet between the orbits of Venus and the Earth.

In the *New York Post* of May 6th, appeared an article signed by Samuel Beswick, in which he announced that a planet had been seen by him to cross the solar disk, on the 12th of February, 1864, at 8 h. 20 m. A.M. No particulars of this observation are given, and the whole affair is stated in such a manner, as to throw doubt on the authenticity of the observation. And this doubt becomes stronger in attempting to verify some of his computations. It was also stated that this planet would cross the solar disk on the 18th of June.

An ephemeris was given of its position from the 5th to the 20th of May: this ephemeris is totally erroneous, since it is impossible for any planet inside the Earth's orbit to be in the position he had assigned.

Prof. Hough also made some remarks on the supposed intermercurial planet alleged to have been seen by Dr. Lescarbault, on the 26th of March, 1859. The experience of the past seems to show that this planet does not exist.

Leverrier was the first to predict a planet, or zone of planets, between Mercury and the Sun, from the fact that the motions of Venus could not well be represented on any other hypothesis. But it has recently been shown by other able mathematicians, that this assumption is not necessary; but by attaching less importance to the ancient observations, and introducing some slight changes in the masses of Mercury and the Earth, all the modern observations can be well satisfied.

At the conclusion of Prof. Hough's remarks, Dr. F. B. Hough read an extract from the *History of Duryea's Brigade*, giving an account of the campaign in Maryland, in 1862, under General McClellan.

Dr. S. D. Willard read a brief biographical sketch of Dr. Edwin James, a late member of the Institute.

Edwin James was the youngest of ten sons of Deacon Daniel James, a native of Rhode Island. Edwin was born in Weybridge, Addison county, Vermont, August, 1798. He was graduated at Middlebury College, and studied medicine with his brother, Dr. Daniel James, of Albany. He was a diligent student in the natural sciences and his talents attracted the attention of scientific men at an early age.

He was appointed by John C. Calhoun, secretary of war, botanist and geologist to Major Long's expedition to the Rocky mountains in 1820, when he was scarcely twenty-one years old. He was many weeks with the expedition, composed of twenty persons, in the wilderness of the great west along the chain of the Rocky mountains, and on the 13th and 14th of July, 1820, ascended the highest peak of the mountains, which bears his name, James Peak. The expedition traversed south towards the source of the Red river, and reached Fort Smith on the 13th of September, being over three months among the Indians. The information gained, and the contributions to the botany, natural history and geology of the country, were cordially welcomed by the scientific world.

An account of the expedition, *Long's Expedition*, etc., was published in three volumes, pp. 344, 356, 347, in London, 1823, and is dedicated to John C. Calhoun.

He was subsequently appointed surgeon in the army, and was stationed at the West Troy Arsenal, and at Sault St. Marie. He published a translation of the New Testament into the Chippewa language, under the title of "Kekitchemanitomenahn Gabemahjcinnunk Jesus Christ Otoashke Waweveendummahgawin, Albany: Packard and Van Benthuysen, 1833;" also a Life of John Tanner, a lad stolen by Indians, and found thirty years after. He was as-

sociated with Edward C. Delavan, Esq., in 1835, in publishing a journal devoted to temperance. He was a man of industry, energy and enterprise, fond of novelty and adventure. He died from an accident near Burlington, Iowa, on the 28th of October, 1861, at the age of sixty-three years.

Dr. Willard read also a notice of Dr. William Bay, who still survives in the ninety-first year of his age.

Dr. Bay is of French Huguenot extraction, his ancestors fleeing first into Holland, and subsequently to Ireland, from whence Mr. Bay with two sons came to Maryland, about 1720. One these sons, John Bay, born 1743, and died 1818, was the father of William Bay, who was born in Albany, October, 14th, 1773. His mother was born 1745, and died at the age of one hundred years. He went to Princeton College, but left in his senior year, studied medicine in New York, acted for four months as health officer to the port of New York in 1795, graduated in 1797, practiced in Columbia county until 1810, when he returned to Albany, where he continued in practice until he had completed sixty-three years of professional life. A public dinner was given to him upon the completion of his half century in practice, by the physicians of the city. The event took place at Congress Hall in 1847. He was present at the semi-centennial meeting of the Albany County Medical Society in 1856.

Dr. Bay's wife, Catharine Van Ness, lived with him sixty-eight years, and died at the age of eighty-seven, January 24, 1864. A brother, John Bay, lived with the doctor for many years, and died April 13, 1864, at the age of eighty-two years.

Dr. Bay's lifetime covers the birth and growth of our nation. He survives, full of dignity and full of years, in remarkable mental and physical elasticity, probably the oldest physician in the country.

At the conclusion of Dr. Willard's paper, Dr. F. B. Hough made a verbal report of the volumes of unbound material which the binding committee had sent to be bound. Adjourned.

June 7th, 1864.

Sixteen members present. On motion of Mr. Brown, Dr. Hough took the chair.

The paper of the evening was read by C. B. Redfield. Esq., being an account of a Pedestrian's Tour through the West, taken in 1810, from Connecticut to the Ohio, by W. C. Redfield.

The account of the journey was read from the journal of the traveler who made the trip, written at the time. Commencing the journey October 5th, 1810, it was finished on the 29th of the same month, making a distance of seven hundred and thirty miles, and containing accounts of the various places through which they passed and the people that were met with. A village of Shakers which was visited is minutely described, and the ceremonies which are recorded are amazingly exact with those to be seen at the present day in the same place.

The travelers left Schodack, October 8th, and proceeded towards Albany. A race course was passed over which a man was riding his horse to accustom him to the ground, and "this was one indication, that the travelers had left New England." They had also noticed other differences since entering New York. "About 8 o'clock we passed through Greenbush and soon after crossed the Hudson. One of the first objects that engaged our attention on entering Albany, was the celebrated steamboat. The streets are generally of a good width and are well paved and provided with lamps. The immense number of wagons that frequent this city cause a great deal of rattling which is very disagreeable to a stranger. The public buildings are mostly in the modern style, and very hand-

some. The Capitol is a handsome structure, on the cupola of which is a statute of justice leaning upon her sword and lifting aloft her nicely balanced scales. The private buildings are many of them splendid, but some of the streets contain a considerable number of old Dutch buildings which with their conical roofs make a grotesque appearance. The soil in the neighborhood of Albany is uncommonly shallow and unproductive, but its advantageous situation as a place of trade renders it one of the most flourishing cities in our country."

This same evening the travelers were compelled by the rain to spend the night at Schenectady, which is described as "a city very compact and handsomely built, but, like Albany, contains a number of Dutch edifices."

The next day they traveled forty-two miles in a westerly direction from this place, and seem to have met with the usual good and bad luck of travelers who need hotels. After failing to suit themselves at one tavern, where the proprietor was yet in bed in the bar room, when they called at eight o'clock for breakfast, they passed on two miles further, and found a tavern where they "were accommodated with breakfast, and very agreeably entertained with the spluttering Dutch lingo of the Dutch landlady and her numerous family."

At Utica, where they arrived October 11th, the first mention is made of Indians.

The Salina salt works are described, and the manner in which the salt was sent from that place, at that time, given: "It is carried in boats to Lake Ontario, and shipped to Niagara, then carted to Fort Schlesser at the head of the Rapids, from whence it is conveyed in boats to Buffalo. Here it is put on vessels and conveyed to the different ports on Lake Erie. Considerable quantities of it are carried from Presque Isle to Pittsburgh, by way of

French creek and the Alleghany river, from whence it is sent down the Ohio."

October 25. The travelers remained for a day at Ashtabula, Ohio, to join in a wolf and bear hunt, in which the whole township mustered out to form a long line of attack, which fronted upon the lake towards which they advanced.

October 28. At Cleveland, several parties of hunting Indians were passed, and one chief is described, who was superbly decorated, and mounted on horseback.

Adjourned.

November 22, 1864.

Twelve members present. On motion of Dr. Townsend, Mr. Munsell took the chair.

The report of the binding committee was received, announcing the binding of one hundred and thirteen volumes for the library, and a bill of $89.27 from T. Seymour, for binding, which accompanied the report. Ordered paid.

Dr. Howard Townsend mentioned an interesting circumstance connected with the Sinai manuscripts of the Bible, to which he had called the attention of the Institute during the last year. Having received an application from a biblical scholar, for information concerning the verse found in I, John, v, 7, he had examined his copy of Dr. Tischendorf's Sinai manuscript with reference to it. The verse has been considered as an interpolation, the tradition being that Saint Augustine had added this as a note to the sixth verse, and as a side note it was printed between the sixth and eighth verses, in smaller type. This was in the fifth century, and during the sixth and eighth century. During the tenth century, and in the King James's translation, it was entered as the seventh verse of the text.

His examination had revealed the fact that the verse is wanting in this old manuscript.

Dr. J. V. Lansing and Dr. J. L. Babcock, were nominated as resident members.

Dr. Howard Townsend nominated S. Alofsen, of Jersey city, as honorary member, and John Fowler, Jr., of New York, as corresponding member of the Institute.

Dr. Willard moved that the secretary be requested to prepare a list of the resident, corresponding and honorary members of the Institute for publication. Adopted.

On motion of the secretary, a committee was appointed to examine the minutes of the meetings of the Institute, and collect the various amendments which have been made to the constitution and by-laws. The chair appointed as such committee, Dr. Mosher, and Prof. Mason.

Adjourned.

December 6th, 1864.

Thirteen members present. On motion of Mr. Brown, Mr. Redfield took the chair.

Dr. Willard read a paper on the condition of the insane poor in the county poor houses and asylums in the various counties of the state. The paper was an exceedingly full report, being a series of reports from all of the counties in the state except four: the reports were in answer to a communication from Dr. Willard, and were to be presented to the legislature, at its next session, in order to bring about much needed reforms in the treatment of this unfortunate class.

The names previously nominated for membership were acted upon, and Dr. John. V. Lansing and Dr. James L. Babcock were elected resident members of the Institute.

John Fowler, Jr., of New York, was elected a corresponding member.

On motion of Dr. Hough, it was resolved, that a copy of the fourth volume of our Transactions be presented to Mr. William Menzies, a corresponding member of the Institute.

Dr. Willard nominated Henry T. Buel as a resident member.

On motion of Prof. Mason the time of meeting was changed to the alternate Monday evenings during the winter.

Adjourned.

December 19, 1864.

Seventeen members present. On motion, Mr. Brown took the chair.

The secretary announced the reception of the first number of the proceedings of the Nova Scotia Institute of Natural Science, and on motion that society was placed upon the exchange list of the Institute.

The secretary announced a communication from the Essex Institute, inquiring if there are any names to be inserted in the work entitled, the *Naturalist's Dictionary* which they are about to publish.

Dr. F. B. Hough moved that a special committee be appointed to take charge of the matter. The chair appointed as such committee, Dr. F. B. Hough, and Prof. Hall.

Henry T. Buel, nominated at the last meeting, was elected a resident member of the Institute.

S. Alofsen, proposed at the meeting held four weeks since, was elected an honorary member.

Dr. Willard nominated Dr. Levi Moore, for resident member; Mr. Jackson nominated John A. Cooper, for resident member; Mr. Cruikshank nominated Michael P. Cavert, for resident member; Mr. Reid nominated Sir J. Bernard Burke, Ulster, King at Arms, Dublin Castle, Ireland, for honorary member.

Dr. Hough read a paper on the proposed census of 1865.

Adjourned.

January 4th, 1865.

On motion, Dr. Howard Townsend took the chair. The treasurer's report of receipts and expenditures for 1864 was received.

The report was referred to the usual committee for examination, the following committee being appointed for that purpose: Dr. F. B. Hough, Mr. Munsell.

The chair announced that this was the annual meeting of the Institute, and that the election of officers would be next in order.

On motion, a committee to nominate officers for the ensuing year was appointed, consisting of Messrs. Munsell, Brown, F. B. Hough.

The committee made the following report which was received, the committee discharged, and the persons named being balloted for were unanimously elected to the respective offices for the year:

John V. L. Pruyn, President.
Andrew E. Brown, Treasurer.

First Department —

Richard V. De Witt, President.
James Weir Mason, Rec. Secretary.
John Paterson, Cor. Secretary.
Franklin B. Hough, Librarian.

Second Department —

Stephen Van Rensselaer, President.
Peter Gansevoort, Vice President.
S. Oakley Vanderpoel, Rec. Secretary.
Joel Munsell, Cor. Secretary.
Charles B. Redfield, Treasurer.

Third Department —

Alexander S. Johnson, President.
Howard Townsend, Vice President.
Jacob I. Werner, Rec. Secretary.
J. Meredith Read, Jr., Cor. Secretary.
James Cruikshank, Treasurer.

Curators—James Hall, Charles H. Anthony, Sylvester D. Willard, George W. Hough, Amos Dean, Jacob S. Mosher.

Mr. Munsell announced a letter of acceptance from Solomon Alofsen, elected honorary member at the last meeting of the Institute.

The letter is accompanying. Ordered recorded on the minutes.

Jersey City, Dec. 29, 1864.

Joel Munsell, Esq., Corresponding Secretary, Albany Institute.

Dear Sir: I acknowledge the receipt of your favor of the 26th inst., advising me of my election as an honorary member of the Albany Institute. I tender my grateful thanks to the Institute for this honor, which I the more highly appreciate, as having been bestowed by an Institution located in a city, which of all American places, is by Hollanders regarded with uncommon interest, as the spot where Dutch literature and history yet find many eminent and learned students and scholars. With sincere wishes for the continued prosperity and usefulness of the Institute, I have the honor to be,

Dear sir,

Yours, very respectfully,

S. Alofsen.

The committee appointed to examine the treasurer's account, reported that they have performed the duty assigned to them, and find the same correct.

The amount received during the year is $501.67. Accounts paid during the year, $402.30; leaving a balance in the treasury of $99.37. Report received and committee discharged.

On motion of Mr. Reid, the rules were suspended, and the name of Sir J. Bernard Burke, proposed at the last meeting, being considered, he was unanimously elected honorary member of the Institute.

The names of Dr. Levi Moore, John A. Cooper, and Michael P. Cavert, nominated at the last meeting, were voted for, and they were unanimously elected resident members of the Institute.

Mr. Cruikshank nominated Samuel T. C. Sweezey of San Francisco, Cal., for corresponding member.

Dr. Mosher nominated Simon W. Rosendale for resident member.

On motion, it was resolved that Prof. Hall be invited to give an account of the recent discoveries in the Canadian limestones, at the next meeting of the Institute.

Dr. F. B. Hough called attention to an original manuscript copy of the proceedings of the commission appointed by the United Colonies to confer with the Indian tribes in 1775, concerning their relations to the two armies, then at war in this country, and requested permission to make use of it for publication, a certain number of copies to be presented to the Institute.

On motion the permission was granted.

Adjourned.

January 17th, 1865.

Prof. Hall then read a paper on Recent Progress in Geology, of which the following is an abstract:

Mr. Hall began by reverting to the early views of geologists regarding the structure of the earth, when all the crystalline granite rocks were considered as a part of the original primary nucleus of the globe; and it was supposed that the stratified rocks, derived from the gradual breaking down and wasting of these crystalline masses, had been deposited around them.

Even to the present time, these mountain ranges of crystalline rocks were regarded as having been uplifted or thrust upwards, by some internal force, and were still considered as parts of the primary mass of the earth.

In the progress of science, the stratified nature of some of these crystalline rocks had been determined; and it was even proved that certain rocks, which in one part of the country were stratified aqueous deposits containing fossils, were in other places crystalline, and without evidence of their aqueous origin.

These crystalline rocks and mountain ranges were found to have a longitudinal extension, and many of them in a generally north and south direction; and this was explained by supposing longitudinal fissures, or lines of outbursting of the interior mass.

This flanking of the older crystalline rocks by the newer sedimentary rocks had been proved to a certain extent true in New York and Canada.

Great impulse had been given to geological science in this country by the institution of State Geological Surveys in which we followed the example of the countries of Europe. The results of the New York Survey had done more than all the others to promote true knowledge of geology.

The reports of this survey had for the first time announced and demonstrated by abundant testimony the true sequence among the American rocks.

In the process of this science it had been determined that the crystalline granite rocks of northern New York were stratified, and though they were termed primary, their stratified structure proved them to be of aqueous and not of igneous origin. In the progress of the Canadian Geological Survey, it had been determined that the older gneissic and granite rocks alternate with extensive limestone bands, and these limestone bands have been traced over large areas of country, even in the most extreme wilderness; their presence being usually indicated by the growth of maple and similar woods, while beech and evergreens mark the course of the silicious rocks.

These limestone bands and their associated gneissoid rocks, had been traced to their junction with the great mountain masses of Labradorish feldspar, such as formed the highest mountains of northern New York, and were found to pass beneath them, thus proving the more recent origin of the latter, and since the limestone bands rested upon the gneissic rocks, it was evident that these could not have been elevated by outbursts from below.

Prof. Hall here went on to show how this discovery demonstrated in these older formations the truth of the origin of mountain chains which he had brought to the notice of the Institute several years since: viz., that mountain elevations were produced by the accumulations of sedimentary materials, and that the highest portions were in reality synclinal axes and not anticlinal axes, as usually supposed.

He reminded the Institute that some years since, in discussing the question of the age of the older crystalline rocks, he had announced the fact that in the older granite rocks of Canada, Sir William E. Logan had discovered pebbles of stratified rock. These pebbles, therefore, belonged to a preexisting stratified deposit, or one older than the oldest granite rocks of northern New York and Canada. This evidence proved that below all these crystalline rocks, there were still another set of stratified crystalline rocks; and that we were still as far as ever from the hypothetical crystalline nucleus of the planet.

More recently, certain appearances in these crystalline limestones, lately regarded as primary, had led a few persons to believe that they contained organic remains; and Sir William Logan, following up the investigations, has been able within the last year to demonstrate the occurrence of fossils in this rock. The fossils of these so-called primary formations, belonged to the class of the foraminifera, a protozoön of peculiar and interesting type.

At the close of the geological survey of New York, we had carried the evidence of life to the lower beds of the Potsdam sandstone, and this had been regarded by some as the final or earliest limit of life on this planet, and theories had been framed accordingly.

There were some, however, who were unwilling to assent to such views; believing in the probability that the older formations might yet give evidence of organic existences.

This late discovery has carried back the evidences of organic life infinitely beyond what was before known, for below the Potsdam sandstone there was a great accumulation of slates, sandstones and conglomerates known as the Huronian system, and below this the great formation of Labradorite feldspar forming mountain masses, while below all these the Eozoon had been found.

Mr. Hall regarded this discovery as the most important for geological science of any during the present age, and of more importance to the establishment of true views regarding geology than any single discovery ever made.

Adjourned.

January 30th, 1865.

Gen. Read then read a paper upon the family of Saxe Coburg, tracing the history of the family from Frederick the warlike, who in A. D. 423, obtained the electorate of Saxony, and marking the various steps of genealogical descent from that date, past the division into Albertine and Ernestine branches, to Prince Albert of Saxe Coburg, Prince Consort of England, and 15th in descent from Frederick the warlike. The article contained many interesting and little known incidents of early German history and family traditions.

Dr. F. B. Hough offered to the notice of the Institute, a paper written by Judge Dean, of Oneida county, embodying the Indian tradition upon the subject of the creation.

Judge Dean, whose family removed from New England to the banks of the Susquehanna, when he was very young, graduated at Dartmouth College, before the Revolution, and spent the rest of his life on the frontiers. He filled various posts of trust and honor in his county, and was especially noted for his knowledge of the Indians. This paper had been supposed lost, and was so described in *Jones's History of Oneida County.* Dr. Hough had discovered it in Utica. The tradition, as here recorded, bore a striking resemblance to that published in 1825, by David Cusick, the Tuscarora Indian, as current among his people. This tract of Cusick, Dr. Hough also submitted to the Institute.

Prof. G. W. Hough called the attention of the Institute to a recent article in the *Scientific American*, describing an instrument for recording music as it is played, of which the mechanism was said to be a secret. He proposed to explain how such a thing could be done. The method employed (as he supposed) is to cause the keys, in their motion when played upon, to break a complete galvanic circuit, thereby alternately elevating and depressing magnets connected with them, and causing marks to be made upon strips of paper, which should be made to pass across the magnets by simple clock work.

Prof. Hough further suggested a plan for a self-registering barometer, by arranging at different heights in the tube of a syphon barometer, wires connected in a similar way with the galvanic battery and with magnets, so that the mercury in rising and falling should make or break the circuit, and cause in the former case the magnets to work upon paper moving under them by clock work.

As a modification of this plan, it was suggested to use a float barometer, and have connected with the float a needle, which should mark upon paper prepared in the same manner as for Bain's telegraph.

Dr. Mosher mentioned a fact concerning the presence of arsenic in fuel, to which attention had been directed during the trial of Mrs. McCarthy, for poisoning her husband. "She had thrown a package of poison into the stove, and as I found arsenic in the chemical analysis of portions of McCarthy's body, it seemed probable that if this were the substance which had been thrown into the fire, it would be found sublimed in the flues and pipes. At the request of the district attorney, I examined some soot taken from the cooler parts of the stove and found it to contain a comparatively large quantity of arsenic.

The important bearing of this fact upon the result of the trial, made it proper to examine it more fully, and I found that in all the stoves which were subjected to a similar examination, arsenic was found in the flues where it had been evidently deposited from the burning fuel.

The finding of arsenic in the soot has, in several criminal cases, been used to prove the possession of arsenic by the accused. In the case of Mrs. Mary Roosa, tried at Syracuse, N. Y., February 7, 1858, the finding of arsenic in soot taken from the stove pipe, was used as showing that some arsenic had been thrown into the stove.—*United States Medical Transactions* for 1862, p. 160."

Gen. Read nominated as resident member, Mr. Robt. L. Banks; and Dr. Hough nominated Mr. Daniel J. Pratt. On motion, the rules were suspended, and the Institute proceeded to vote on the candidates, viva voce. Both were unanimously elected.

Mr. James Wier Mason nominated as corresponding member, Mr. Russell Sturgis, Jr., of New York.

Adjourned.

February 13th, 1865.

The president being absent, on motion, Dr. Hun was called to the chair.

Prof. G. W. Hough offered remarks on the subject of Personal Equation.

He gave a general discussion and exposition of the subject, reviewing the ground of a previous lecture before the Institute. In that lecture he had alluded to the method of testing personal equation in use at the Dudley Observatory, by means of the chronograph. At this time he had the instrument in the room, explained its working to the members, and tested its operation, by taking the personal equations of those present.

The apparatus consists of a circular disk, divided by radial lines into equal angular spaces. On the under edge of the disk are placed large pins at equal intervals. The disk being made to revolve at a uniform rate, by means of simple clock work, and the observer looking towards it from across the room through a small telescope, would see these pins pass at equal intervals of time, across his line of sight. The instant of the passage is marked by the observer's completing the circuit of an electric current by simple pressure of the hand on a small magnet, thus causing a mark to be made upon a sheet of paper stretched upon the disk, in the same way as marks are made in an ordinary telegraphic instrument. The distance of the mark behind the line passing through the pin determine the equation of the observer.

Dr. Hough stated that a member was desirous of purchasing a copy of the Transations published by the Institute. On motion, the request was referred to Mr. Munsell and the treasurer with authority.

The following nominations for membership were made: By Paul F. Cooper, Mr. Leonard Kip; and by Dr. Mosher, Peter Hogan, both as resident members; by Gen. Read, Mr. Horatio Gates Jones, secretary of the Pennsylvania Historical Society, and Rev. Leighton Coleman, Wilmington, Del., as corresponding members; by Dr. Hough, Mr. Henry B. Dawson, of Morrisania, as corresponding member; by

Mr. Mason, Everett P. Wheeler, Esq., of New York, as corresponding member.

On request of Dr. Hough, he was authorized to have certain pamphlets bound.

Adjourned.

February 27th, 1865.

Eighteen members present.

A paper was read by Dr. Howard Townsend, entitled, "Food and Digestion, with a review of the Banting pamphlets," a copy of which is contained in vol. v, of the Transactions of the Institute.

Prof. Hough stated that he had worked out from the data obtained at the previous meeting, the personal equation of the members, and placed the figures on the black board. They were found to vary from .01 anticipated, to .16 retarded, the average being about .037 retarded.

Dr. Mosher reported having procured the pamphlet cases as directed by the Institute.

For election of members, the rules were suspended and the votes taken viva voce. The candidates for election were all chosen, viz: Leonard Kip and Peter Hogan, as resident members; Russell Sturgis, Jr., Horatio Gates Jones, Rev. Leighton Coleman, Henry B. Dawson, and Everett Wheeler, as corresponding members.

Adjourned.

MANUAL

OF THE

ALBANY INSTITUTE:

PREPARED

UNDER THE ORDER OF THE INSTITUTE,

MARCH, 1870,

By DANIEL J. PRATT,
RECORDING SECRETARY.

ORIGIN OF THE ALBANY INSTITUTE.

The "Society for the Promotion of Agriculture, Arts and Manufactures" was formed in February, 1791, at the city of New York, then the seat of government of this state, and was incorporated by the Legislature March 12th, 1793. Of this body, Robert R. Livingston (well known as one of the committee appointed to draft the Declaration of Independence, first Chancellor of the State of New York, Minister to France, etc.), was designated in the act of incorporation as the first president, and so remained until the year 1804, when the act expired by its own limitation. The society was then reincorporated under the title of "The Society for the Promotion of Useful Arts," by an act of the Legislature, passed April 2, 1804, which also constituted Mr. Livingston its first president. Of the labors of this Society, it is enough to say that four octavo volumes, mainly composed of communications read at its sessions, were published; that it exerted a most favorable influence upon agriculture; and that it was for five years the organ of the state in distributing premiums for improvements in domestic manufactures.

"The Albany Lyceum of Natural History" was organized early in 1823, under the presidency of Stephen Van Rensselaer, and was incorporated by the Legislature on the 23d day of April in that year. Directing its labors to the

advancement of a knowledge of the natural sciences, it succeeded in forming a museum embracing collections in the various branches, especially geology, mineralogy and palæontology, which were for a time regarded as the most extensive and valuable in the country.

Circumstances induced a majority of the members of the two latter societies to believe that the objects for which they had been incorporated would be promoted by mutual coöperation; and accordingly, in May, 1824, articles of association were agreed to, providing for the organization of "The Albany Institute." The substance of these articles is embodied in the charter granted by the Legislature, February 27th, 1829. It appears from the several charters above mentioned, copies of which are included in this publication, that the Albany Institute is the legitimate successor of the pioneer series of associations formed and incorporated within this state for the promotion of science; and it will be observed that the annexed roll of members includes many persons of distinction as scholars, as well as in professional and civil life.

CHARTER

OF THE

SOCIETY FOR THE PROMOTION OF AGRICULTURE, ARTS AND MANUFACTURES.

AN ACT *to incorporate the Society, instituted in the State of New York, for the Promotion of Agriculture, Arts and Manufactures.*

Passed March 12, 1793. Chap. 59.

WHEREAS several persons in the state of New York have by a voluntary agreement associated themselves together for the laudable purpose of promoting agriculture, arts and manufactures in this state; *And whereas* the said society have presented a petition to the legislature, setting forth, that the petitioners, considering that the wealth and prosperity of a country very much depend upon the flourishing state of its agriculture, arts and manufactures, and observing the benefit[s] which in other countries have accrued from the institution of societies for the purpose of encouraging those great objects, have voluntarily associated themselves, with a view of collecting from different parts of the state, the different modes of agriculture that are in practice, to suggest such improvements as may be found to be beneficial; to excite among their fellow citizens a spirit of making experiments for the amelioration of lands which have been exhausted, or in their natural state are unproductive or unfit for cultivation; for increasing the produce of such articles as are propagated amongst us, and promoting the culture of others which have been found useful in other parts, and for the improvement of field husbandry in general; and to introduce, as far as circumstances may

render proper, an emulation for the establishment of useful arts and manufactures in those parts of the state where they can be beneficially carried on; that the petitioners conceive it would greatly conduce to advance the important ends of their association, if they were authorized to act as a corporate body, and possess property to such amount as would enable them to effectuate their purposes more satisfactorily to themselves and more beneficially to the public: They therefore prayed, that the legislature would be pleased, by law, to incorporate the society for the purposes aforesaid, under such limitations and restrictions as to the legislature shall seem meet; Therefore,

§ 1. *Be it enacted by the People of the State of New York, represented in Senate and Assembly:* That Robert R. Livingston, John Sloss Hobart, Samuel L. Mitchill, John M'Kesson, Matthew Clarkson, Samuel Bard, John Cantine, Samuel Jones, Thomas Tillotson, Joseph Hasbrouck, James C. Graham, Jacobus Swartwout, Melancton Smith, Abraham Hardenberg, John Gelston, William W. Gilbert, David R. Floyd Jones, George Clinton, Aquila Giles, Ezra L'Hommedieu, John Skenck, James Hunter, Egbert Benson, John Blagge, John P. Delancy, Francis Childs, John Watts, Peter Vandervoort, Henry Will, Ebenezer Purdy, Josiah Ogden Hoffman, John Smith of Suffolk county, Cornelius J. Bogart, William Dunlap, Walter Rutherford, Philip Van Cortlandt, John Williams, Richard Varick, John Jay, Elias Newman, Amasa Dingley, Gilbert Colden Willett, Stephen Lush, John Stevens, John Kemp, Abraham Beach, Samuel Nicoll, Jonathan N. Havens, John L. Gardner, Frederick Rhinelander, Pierre De La Bigarre, Edward Livingston, John Thurman, Jeremiah Van Rensselaer, James Duane, Simeon DeWitt, Nathaniel Sackett, William Rhinelander, Samuel Russell, Moses DeWitt, David Frederick Laring, John Nicholson, Andrew King, John Barber, Joseph Barber, Johannes

Miller, William Thompson, David Ogden, John Delafield, Horatio Gates, Benjamin Strong, and Samuel Jones, Jr., and such other persons as shall from time to time become members of the said society, shall be and hereby are ordained, constituted and declared to be one body corporate and politic, in deed, fact and name, by the name of, The Society for the Promotion of Agriculture, Arts and Manufactures; and that by that name, they and their successors *until the first day of May one thousand eight hundred and four*, shall have succession, and shall be persons in law capable of suing and being sued, pleading and being impleaded, answering and being answered, defending and being defended, in all courts and places whatsoever, in all manner of actions, suits, complaints, matters and causes whatsoever; And that they and their successors may have a common seal, and may change and alter the same at their pleasure; and that they and their successors, by the same name, shall be persons capable in law to purchase, take, receive, hold, and enjoy to them and their successors, any real estate in fee simple, or for term of life or lives, or otherwise; and any goods, chattels, or personal estate, for the purpose of enabling them the better to carry into execution, encourage and promote such measures as may tend to promote agriculture, arts and manufactures in this state: *Provided*, the clear yearly value of such real and personal estates shall not exceed the sum of eight hundred pounds lawful money of New York, and that they and their successors shall have full power and authority to give, grant, sell, lease, demise and dispose of the said real and personal estates, or any part thereof at their will and pleasure; and that they and their successors shall have power from time to time, to make, constitute, ordain and establish such by-laws, constitutions, ordinances and regulations as they shall judge proper for the election of their officers, for the election or admission of new members of the said corpora-

tion, and the terms and manner of admission, for the better government and regulation of their officers and members, for fixing the times and places of the meeting of the said corporation, and for regulating all the affairs and business of the said corporation. *Provided*, That such by-laws and regulations shall not be repugnant to the constitution or laws of the United States, or of this state. And for the better carrying on the business and affairs of the said corporation, there shall be a president, vice-president, treasurer and two secretaries of the said corporation, who shall hold their offices from the time of their appointment or election, until the second Tuesday of January then next, and until others shall be chosen in their places. And that the said Robert R. Livingston is hereby appointed president, the said John Sloss Hobart, vice-president, the said Samuel Jones, treasurer, and the said Samuel L. Mitchill, and Samuel Jones, junior, secretaries of the said corporation; and that their successors in office shall hereafter be chosen by the members of the said corporation, in such manner and at such times and places, as shall be directed by the by-laws of the said corporation to be made for that purpose; and that the president or vice-president, and any twelve or more of the members of the said corporation, shall be sufficient to constitute a legal meeting of the said corporation.

§ 2. *And be it further enacted:* That the members of the legislature, who shall not be styled members of the said corporation, be nevertheless in virtue of their stations honorary members of the said corporation, and shall sit but not vote as such for officers, or have any voice in the disposition of their funds.

CHARTER

OF THE

SOCIETY FOR THE PROMOTION OF USEFUL ARTS.

AN ACT *to incorporate a Society for the Promotion of Useful Arts.*
Passed April 2, 1804. Chap. 41.

WHEREAS the institution of a society calculated to promote, collect and preserve the knowledge of useful arts, is intimately connected with the public welfare and prosperity: Therefore,

§ 1. *Be it enacted by the people of the state of New York, represented in Senate and Assembly*, That all such persons who shall, at the time of the passing of this act, be members of the society for the promotion of agriculture, arts and manufactures, and such other persons who shall from time to time become members of the society hereby intended to be incorporated, and shall within ten months after the passing of this act, signify their intention in writing, subscribed by them respectively, to Samuel L. Mitchill or Benjamin De Witt, the present secretaries of the said society, to become members of the society hereby intended to be incorporated, and shall pay to either of them two dollars for the use of the said society, shall be, and hereby are, constituted a body corporate and politic by the name of "The Society for the Promotion of Useful Arts;" that by that name the said society shall have perpetual succession; and that the said society and their successors shall be capable in law to sue and be sued, plead and impleaded, answer and be answered, defend and be defended, in all courts and in all actions,

suits, matters and causes whatsoever, and to purchase, take, receive, hold and enjoy, any real or personal estate, in fee, simple or otherwise, and the same to lease, sell, dispose of and convey for the purpose of the better enabling them to carry into effect such measures as to the said society shall seem best calculated to promote agriculture, arts and manufactures within this state: *Provided*, That the clear annual value of such real and personal estate shall not exceed the sum of two thousand five hundred dollars: That the said society shall have a common seal, which may from time to time be changed or altered at its pleasure.

§ 2. *And be it further enacted*, That the said society shall, from time to time, forever hereafter, have power to make, constitute, ordain and establish such by-laws and regulations as they shall judge proper for the election of their officers, for prescribing their respective functions, and the mode of discharging the same; for the admission of new members into the said society; for the government of the officers and members thereof; for ascertaining an equal annual rate of contributions towards the funds thereof; for regulating the times and places of meeting for managing the affairs of the said society, and for suspending or expelling such members of the said society as shall neglect or refuse to comply with the by-laws and regulations thereof, so as such by-laws and regulations shall not be repugnant to the laws of the United States or of this state.

§ 3. *And be it further enacted*, That a president and one or more vice presidents, nine counsellors, two or more secretaries, a treasurer, and such other officers as the said society shall, by any by-law, from time to time appoint, shall be elected by a plurality of votes of the members of the said society present at any election: That such election shall be annually held in the senate chamber, or at such other place as the said society shall from time to time by by-law direct and appoint, on the Tuesday next succeeding the day on

which both houses of the legislature shall have been formed, ready to proceed to business, after the first day of January in every year: That the said officers shall respectively hold their offices until the next annual election day, or until others shall be elected in their stead; That if the annual election shall not be held at any of the days for that purpose appointed, it shall be lawful to make such election at any other day; and that the president, or one of the vice-presidents, with any twelve or more of the said society, meeting at the place designated for that purpose by any by-law, shall constitute a legal meeting of the said society.

§ 4. *And be it further enacted*, That the books, papers, moneys and effects of the Society for the Promotion of Agriculture, Arts and Manufactures, shall be, and the same are hereby with the approbation, and at the instance of the last mentioned corporation, vested in the said Society for the Promotion of Useful Arts, from and after the fourth day of May next, on which day the corporation aforesaid expires by its own limitation.

§ 5. *And be it further enacted*, That the members of the legislature shall in that capacity be honorary members of the said society; but shall not vote at elections, or have any voice in the disposition of the funds of the said society.

§ 6. *And be it further enacted*, That Robert R. Livingston shall be the president, and Ezra L'Hommedieu the vice-president of the said society, until the second annual election day.

CHARTER

OF THE

ALBANY LYCEUM OF NATURAL HISTORY.

AN ACT *to incorporate the Albany Lyceum of Natural History.*
Passed April 23, 1823. Chap. 227.

WHEREAS the members of the Albany Lyceum of Natural History have associated for the purpose of encouraging the study, and of disseminating a knowledge of natural history and other useful sciences, and have petitioned for an act of incorporation: Therefore,

§ 1. *Be it enacted by the People of the state of New York, represented in Senate and Assembly,* That Stephen Van Rensselaer, Theodoric Romeyn Beck, Simeon De Witt Bloodgood, Lewis C. Beck, Matthew Henry Webster, Frederick Mathews, Richard Varick De Witt and James Eights, and such other persons as now are and may from time to time become members, shall be and hereby are constituted a body corporate and politic, by the name of the "Albany Lyceum of Natural History," and by that name they shall have perpetual succession, and shall be persons capable of suing and being sued, pleading and being impleaded, answering and being answered unto, defending and being defended, in all courts and places whatsoever, and may have a common seal with power to change and alter the same from time to time, and shall be capable of purchasing, taking possession of, holding and enjoying, to them and their successors, any real estate in fee simple or otherwise, and any goods, chattels, and personal estate, and of selling, leasing,

or otherwise disposing of said real and personal, or any part thereof, at their will and pleasure: *Provided, however*, That the funds of the said corporation shall be used and appropriated to the objects contemplated in the preamble to this act: *And provided also*, That the clear annual income of such real and personal estate shall not exceed the sum of one thousand dollars.

§ 2. *And be it further enacted*, That the said society shall forever hereafter have power to make, constitute, ordain, and establish such by-laws and regulations, as they shall judge proper for the election of their officers, for prescribing their respective functions, and the mode of discharging the same, for the admission of new members, for the government of the officers and members thereof, for collecting the fines, impositions and annual contributions from the members, for regulating the places and times of meeting of the said society, for suspending or expelling such members as shall neglect or refuse to comply with the by-laws or regulations, and for managing and directing the affairs and concerns of the said society: *Provided*, such by-laws and regulations be not repugnant to the constitution and laws of this state or of the United States.

§ 3. *And be it further enacted*, That the officers of the said society shall consist of a president, two vice-presidents, a corresponding secretary, a recording secretary, a treasurer, three curators, and a draftsman, and such other officers as the said society may deem necessary, who shall be annually chosen, and who shall continue in office for one year, or until others shall be elected in their stead; that if the annual election shall not be held on any of the days for that purpose appointed, it shall be lawful to make such election on any other day, and that five members of the said society assembled at the place and time designated for that purpose by the constitution, by-laws, or resolutions of said society, shall constitute a legal meeting there-

of; and that in case a vacancy shall take place between the annual meetings, then it shall be lawful to fill such vacancy at any regular meeting, and the person or persons so chosen shall continue in office until the next annual meeting, or until others shall be elected in their stead.

§ 4. *And be it further enacted*, That Stephen Van Rensselaer shall be the president, Theodric Romeyn Beck the first vice-president, Simeon De Witt Bloodgood the second vice-president, Lewis C. Beck, corresponding secretary, Matthew Henry Webster, recording secretary, Frederick Mathews, treasurer, Richard Varick De Witt, James Eights and Matthew Henry Webster, curators, and James Eights, draftsman, severally to be the first officers of the said corporation, who shall hold their respective offices until the fourth Monday of January next, and until others shall be chosen in their places.

§ 5. *And be it further enacted*, That the present constitution of the said society shall, after the passing of this act, continue to be the constitution thereof, and that no alteration shall be made therein unless it be proposed in writing at some stated meeting, one month before it is acted upon, and shall be decided by a majority of three-fourths of the members present.

§ 6. *And be it further enacted*, That the legislature may at any time modify or repeal this act.

CHARTER OF THE ALBANY INSTITUTE.

AN ACT *to incorporate the Albany Institute.* Passed February 27, 1829. Chap. 43.

WHEREAS the Society for the Promotion of Useful Arts, and the Albany Lyceum of Natural History, have agreed to articles of association, for the purpose of forming an Institution for the promotion of Science and Literature, to be called "The Albany Institute." Therefore,

The People of the state of New York, represented in Senate and Assembly, do enact as follows:

§ 1. All such persons as shall at the time of the passage of this act, be members of the said "Society for the Promotion of Useful Arts," or of the "Albany Lyceum of Natural History," and such other persons as shall from time to time become members of the same, or of the third department herein after mentioned, shall be and are hereby constituted a body corporate and politic, by the name of "The Albany Institute;" and the annual income of the real and personal estate which the said corporation is authorized to hold, shall not exceed ten thousand dollars.

§ 2. The said corporation shall consist of three departments, viz: First, the department of Physical Sciences and the Arts: Second, the department of Natural History, and, Third, the department of History and General Literature. "The Society for the Promotion of Useful Arts," as at present constituted, shall be the First Department—"The Albany Lyceum of Natural History," as at present constituted, the Second Department; and a Society for the promotion of History and General Literature shall be formed as soon as may be, which shall be the Third Department:

but until such society shall be formed and duly organized, the said corporation shall consist and be formed of the aforesaid First and Second Departments.

§ 3. The officers of the said corporation shall be a president, three vice-presidents, three corresponding and three recording secretaries; a treasurer, a librarian, and as many curators as the Second Department may direct. The president and treasurer shall be annually elected; and the presidents of the departments shall be the vice-presidents; and the corresponding and recording secretaries of the departments shall be the corresponding and recording secretaries of the Institute; the librarian of the First Department shall be the librarian, and the curators of the Second Department shall be the curators of the Institute: Stephen Van Rensselaer shall be the first president, and Simeon De Witt, at present president of the Society for the promotion of Useful Arts, and Theodoric Romeyn Beck, at present president of the Albany Lyceum of Natural History, shall be the vice-presidents, and William Mayell the treasurer of the Institute; who shall severally hold their respective offices until others shall be chosen in their places.

§ 4. The elective officers shall be chosen by a plurality of the votes of the members of the Institute present, at a regular meeting for that purpose convened, according to the by-laws of the Institute, of which previous notice shall be given in at least one of the newspapers published in the city of Albany.

§ 5. If at any regular meeting of the Institute for the election of officers, any or either of the Departments constituting the Institute shall not continue organized or be in any way dissolved, such officers of the institute as are hereby declared to be *ex officiis* from the said Departments, may be elected by the Institute in the same manner as the other elective officers are directed to be chosen.

§ 6. Nine members of the Institute, regularly convened, shall constitute a quorum for the transaction of business, and five members of either of the Departments regularly convened, shall constitute a quorum for the transaction of business in such department.

§ 7. The books now belonging to or hereafter coming into the possession of the aforesaid Departments, shall be deposited in the library of the said corporation, and all specimens of natural history or the arts, now or hereafter belonging to or coming into the possession of either of the said departments, shall be deposited in the museum of the said corporation.

§ 8. The corporation shall have power to make, constitute, ordain and establish such by-laws and regulations as they shall judge proper for the election of their officers, for prescribing their respective functions and the mode of discharging the same, for the admission of new members, for the government of the officers and members thereof, for collecting the fines, impositions and annual contributions from the members, for regulating the times and places of meeting, and for managing and directing the affairs and concerns of the said corporation.

§ 9. The legislature may at any time hereafter amend, modify or repeal this act.

BY-LAWS OF THE ALBANY INSTITUTE.

[Adopted May 5th, 1824; amended April 1st, 1829; and Jan. 4th, and 18th, Feb. 1st, and March 15th, 1870; the amendments being incorporated in the text.]

I. Meetings.

1. The regular meetings of the Institute shall be held once a fortnight during the first five, and the last four months of the year.

2. The first meeting in each year shall be held on the first Tuesday succeeding the first day of January, at which time the annual election for officers shall be held; the Recording Secretary to give general notice of the same.

3. At the anniversary meeting, the order of business shall be as follows:

(1.) Call to order by the presiding officer.

(2.) Reading of the minutes of the last meeting.

(3.) Election of officers.

(4.) Report from the Recording Secretary of the number of members admitted during the preceding year.

(5.) Report from the Treasurer of the moneys received and expended during the year.

(6.) Report from the Librarian of the number of books received during the year, the number issued to members during the year, and the number not returned according to regulations.

(7.) Report from the Curators of the number of specimens, natural and artificial, added to the collections.

(8.) Appointment of committees to examine the above reports.

(9.) Amendments to the by-laws duly proposed at a previous meeting.

4. At the other regular meetings, business shall be transacted in the following order:

(1.) Call to order by the presiding officer.

(2.) Reading of the minutes of the last meeting.

(3.) Communications, papers, lectures, &c.

(4.) Reports of committees.

(5.) Miscellaneous business.

5. Special meetings may at any time be called by the presiding officer, upon giving notice in one of the daily city newspapers, or by messenger.

II. Duties of Officers.

6. The President shall preside at all the meetings, nominate and appoint all committees, have a casting vote in case of a tie, declare the decisions of the Institute, and call extraordinary meetings when he shall consider them necessary.

7. In the absence of the President, one of the Vice Presidents shall preside, who shall have all the powers granted to the President.

8. In addition to the Recording Secretaries of the several departments, there shall be chosen annually a Recording Secretary for the Institute at large, who shall keep the minutes of the Institute, give notice of the anniversary and other meetings, notify new members of their election, and transact such other business as may be directed by the by-laws, or by a vote of the Institute. In the absence of the Recording Secretary, one of the Recording Secretaries of the Departments shall perform the duties of his office, on the request of the President.

9. A Corresponding Secretary of the Institute at large shall also be elected annually. He shall conduct the corre-

spondence of the Institute, and shall from time to time communicate such information as he may have received relative to its objects. In his absence, one of the Corresponding Secretaries of the departments shall perform his duties, on the request of the President.

10. The Treasurer shall receive the moneys belonging to the Institute, keep an account of all receipts and expenditures, and pay accounts as follows:

For periodicals directed to be taken, to be audited by the Librarian, who shall certify that he has received the same.

For contingent expenses, to be certified by the President or either of the Vice Presidents.

For other purchases or expenditures directed by a vote of the Institute, to be certified by the Recording Secretary with a copy of the minutes relative thereto.

11. The Curators shall take charge of such specimens in Natural History and the Arts as may from time to time be received by the Institute, either on loan or by donation; in the former case, they may give receipts for specimens subject to the direction of the person who may deposit the same, and they shall keep the collections under such regulations as may be prescribed.

12. The Librarian shall take charge of all the books and manuscripts belonging to the Institute or on deposit. He shall loan no books except to members, and in such cases only in conformity with such regulations as may be prescribed. He shall keep a record, in a book kept for that purpose, of all books loaned to members, and when returned, and shall at each annual meeting report in writing the condition of the Library, the number of volumes received during the year, the number issued to members during the year, and the number not returned according to regulations.

13. The same person may, if the Institute so elect, hold at the same time the offices of Recording Secretary, and Librarian; and the Institute shall pay to such person, holding either or both of these offices, such annual salary as shall from time to time be decided upon at an annual meeting.

III. Members.

14. There are three classes of members, to wit: Resident, Corresponding and Honorary. Resident members only shall be entitled to vote and to hold office.

15. Candidates for membership shall be nominated at a regular meeting, and their names, together with the names of members proposing them, shall be entered on the minutes. The vote on such nominations shall be taken at the next or some subsequent regular meeting, and by ballot, if desired by any member present. An affirmative vote of three-fourths of the members present shall be necessary to an election.

16. The annual fee of each resident member shall be five dollars, payable on the first of January, in advance; but the payment of twenty-five dollars by or for any clergyman of the city of Albany, duly elected a resident member, shall exempt him from any further payment.

17. The Honorary Members heretofore elected by the several departments are hereby recognized as Honorary Members of the Institute; but no additional Honorary Members shall be recognized, unless elected by the Institute at large.

18. The Governor of the State and the Mayor of the city of Albany shall be *ex-officio* Honorary Members; and shall be entitled to all the privileges of resident members, except the right of voting.

19. A member of any of the departments may become a member of either of the others, on being duly elected and paying the initiation fees and annual contributions required by the by-laws of such department.

20. No member of one department shall be transferred to another, without the consent of the department which he leaves, and that of the Institute.

IV. Classes in the Several Departments.

21. The President of each of the Departments shall, at the annual meeting or the first meeting thereafter, announce the names of members of three classes within his department, of one of which he shall be chairman; each class to consist of three or more members. The duty of these classes or committees shall be, to report annually to the Institute such notes or selected items as may present a brief record of matters of interest in science and literature. They shall report in such order as the Recording Secretary shall arrange at the commencement of the year.

These classes shall be:

In the First Department (*Physical Science and the Arts*):

1. On Physics and Astronomy.
2. On Physiology and Chemistry.
3. On Arts.

In the Second Department (*Natural History*):

1. On Geology.
2. On Botany.
3. On Zoology.

In the Third Department (*History and General Literature*):

1. On Modern History, especially historical records possessing local interest.

2. On Ancient History and Archæology.
3. On General Literature.

Other classes may be formed whenever it is desirable.

The reports of these classes are not to take the place of the usual original communications and papers.

V. Miscellaneous.

22. A by-law of any of the departments which may conflict with any of the by-laws of the Institute, shall be deemed void and of no effect.

23. No exchange or sale of any property of either of the departments shall be valid, unless approved by the Institute.

24. An address shall be delivered before the Institute during the month of May in each year. The election of the person to deliver the annual address shall be held at least a year previous; and on at least a fortnight's previous notice.

25. The Rules of Order for the Institute shall be those of the Assembly of this State.

26. No alteration shall be made in the by-laws, unless proposed at a regular meeting, at least one month previous to being acted on, nor without the concurrence of two-thirds of the members present.

PROCEEDINGS

OF THE

FIRST, SECOND AND THIRD DEPARTMENTS.

For a number of years subsequent to the organization of the Institute, the several departments were accustomed to hold regular meetings for the transaction of their appropriate business, during which period new corresponding and resident members were added to the Institute only by virtue of election to some one of these departments. More recently, while the organization of the departments has been preserved in accordance with the provisions of the charter, the proceedings have been almost wholly conducted by the Institute at large, and new members have not generally been elected to or classified among the various departments. It is hoped, however, that the operation of the new by-law of the Institute relative to "Classes in the Several Departments" (see pp. 22, 23), will tend to renew their efficiency, and to secure to the Institute all the advantages of thorough organization for the promotion of its objects.

CATALOGUE

OF THE

MEMBERS OF THE ALBANY INSTITUTE

FROM ITS

Organization in 1824, *with the Dates of their Election.*

☞ As the Institute was formed by the federal union of the Society for the Promotion of Useful Arts, and the Albany Lyceum of Natural History, dates prior to 1824 are to be understood as referring to membership originating in one or the other of these societies, and continuing under the organization of the Institute. Several of the earlier members of the Institute were also original members of the Society for the Promotion of Agriculture, Arts and Manufactures, incorporated in 1793, their names appearing as such in the foregoing charter of that Society.

☞ The printed list of 1830 (*Transactions*, vol. 1), and a manuscript list of 1858 (*Minutes*, pp. 50, 51), contain names of certain members known or presumed to have been elected at an earlier date, though not so recorded. In such cases the date is that of the list in which the name first appears.

☞ Members understood to be deceased are indicated by an asterisk (*).

☞ The residences given are the latest ascertained, and are to be understood as within this state, unless otherwise indicated.

☞ Information relative to the location, decease, etc., of the non-resident members, and also in regard to any errors and omissions in the list, is solicited by the Recording Secretary. Corresponding and other Members may render valuable service by furnishing brief notices of any of the deceased, for the use of the Institute.

HONORARY MEMBERS.

The Governor of the State of New York, *ex officio.*
The Mayor of the City of Albany, *ex officio.*

1864	Salomon Alofsen,	Jersey City, N. J.
1835	Henry Beaufoy,*	S. Lambeth, Eng.
1865	Sir J. Bernard Burke,	Dublin, Ireland.
1823	De Witt Clinton, LL.D.,*	Albany.
1834	Erastus Corning,	Albany.
1823	Simeon De Witt,*	Albany.
1834	Volckert P. Douw,*	Albany.
1828	Baron von Goethe,*	——, SaxeWeimar.
1870	Joseph Henry, LL.D.,	Washington, D.C.
1837	Sir John F. W. Herschel, F. R. S,,	London, Eng.
1823	David Hosack, L.L.D. F.R. S.,*	New York City.
1816	David Humphreys, LL.D.,*	Canton, Conn.
1834	Washington Irving,*	Tarrytown.

1823	Elisha Jenkins,*	Hudson.
1823	John Lansing, Jr., LL.D.,*	Albany.
1830	Baron von Lederer,*	——, Austria.
1828	John George Lenz, M.D.,	—, Saxe Weimar
1815	Henry E. Muhlenbergh, D.D.,*	Lancaster, Pa.
1863	George Sharswood,	Philadelphia, Pa.
1816	Richard Peters, LL.D.,*	Philadelphia, Pa.
1823	William Swainson,*	—, New Zealand.
1823	John Tayler,*	Albany.
1834	Philip S. Van Rensselaer,	Albany.
1870	Abram B. Weaver,	Deerfield.
1823	Samuel Young,*	Ballston.

Number of Honorary Members, - - - - 25.

CORRESPONDING MEMBERS.

1806	Abraham Adriance,*	Poughkeepsie.
1829	William E. Aiken, M.D.,	Baltimore, Md.
1830	Stephen Alexander, LL.D.	Princeton, N. J.
1815	Benjamin Allen, LL.D.,*	Hyde Park.
1868	Leicester Allen,	New York.
1806	Joseph Annin,*	Aurelius.
1814	Moses Austin,*	Cairo.
1870	Rev. Louis H. Bähler,	Deposit.
1830	Vestus Balch,	Johnstown.
1807	John Ballard,*	Homer.
1836	Robert Balmanno,	Geneva, (?).
1815	Samuel Bard, M.D.,*	Hyde Park.
1837	Arthur Barker,	Hudson.
1815	Robert A. Barnard,	Hudson.
1830	William H. Bassett,	
1823	——, Bassett, M.D.,	Manlius.
1823	David S. Bates,	
1828	Levi Beardsley,*	Cherry Valley.
1828	Jesse Beach, (Capt.), U. S. A.,	——, Conn.
1823	John B. Beck, M.D.,*	New York City.
1823	Timothy P. Beers, M.D.,*	New Haven, Conn.
1833	Rev. Alva Bennett,*	Utica.
1812	Thomas Bicknell,	——, Madison county
1823	William A. Bird,	Black Rock.
1833	Samuel P. Bishop, M.D.,	Cincinnati, O.
1870	Porter C. Bliss,	Washington, D. C.
1811	Francis A. Bloodgood,*	Utica.
1810	Joseph Bloodgood, M.D.,*	Flushing, L. I.
1814	John G. Bogart,*	New York City.
1831	William H. Bogart,	Aurora.
1814	Herman H. Bogert,*	Geneva.
1830	Stephen V. R. Bogert, M.D.,	Staten Island.
1823	Richard M. Bouton,	
1823	John P. Brace,	Litchfield, Conn.
1863	Alvah Bradish,	Fredonia.
1823	Samuel B. Bradley, M.D.,	West Greece.
1813	John Brainard,	Albany.
1830	Isaac Briggs, C. E.,	
1810	Charles C. Brodhead,*	Utica.
1841	J. Romeyn Brodhead,	New York City.

1809	Micah Brooks,*	Brooks' Grove.
1808	John Broome,*	New York.
1808	William Broome,*	Hyde Park.
1807	Jacob Brown,*	——, Jefferson county.
1828	William Linn Brown,	Philadelphia, Pa.
1817	Richmond Brownell, M.D.,*	Providence, R. I.
1812	Thomas C. Brownell, D.D., LL.D.,*	Hartford, Conn.
1808	Archibald Bruce, M.D.,*	New York City.
1829	Cyrus Bryant,*	Princeton, Ill.
1831	David Buel, Jr.,*	Troy.
1807	Salmon Buel,*	
1814	George Bomford,*	Washington, D. C.
1834	Joseph Burbank, M.D.,	Esperance.
1833	Marmaduke Burrough, M.D.,*	Philadelphia, Pa.
1827	William Campbell, M.D.,*	Cherry Valley.
1870	William W. Campbell,	Cherry Valley.
1812	Seth Capron, M.D.,*	Walden.
1812	William S. Cardell,*	Lancaster, Pa.
1835	Matthew Carey,*	Philadelphia, Pa.
1832	William M. Carmichael, D.D.,	Hempstead, L. I.
1859	Philip P. Carpenter, Ph. D.,	Montreal, L. C.
1823	George W. Cartwright,	Sing Sing,
1836	Loring D. Chapin,	New York City.
1815	Moses Chapin,*	Rochester.
1814	Josiah Chapman,	——, Rensselaer county.
1809	James Le Ray De Chaumont,*	——, Jefferson county.
1829	Asa Christy, M.D.,	Fairfield.
1810	Philip Church,*	Belvidere.
1823	Sylvester Clapp,	Bennington, (?)
1817	Aaron Clarke,*	New York City.
1815	Asahel Clarke,	Sandy Hill.
1811	George Clarke,*	Springfield, N. Y.
1817	George Hyde Clarke,*	——, Eng.
1830	Charles A. Clinton,*	New York City.
1823	DeWitt Clinton, LL.D.,*	New York City.
1831	Franklin Clinton,*	U. S. Navy.
1830	George W. Clinton, LL.D.,	Buffalo.
1810	Stephen Close,	Waterford.
1811	Timothy Clowes, LL.D.,*	Hempstead, L. I.
1813	James Cochran,*	Palatine.
1808	Walter L. Cochran,*	——, Montgomery county.
1865	Rev. Leighton Coleman,	Wilmington, Del.
1820	Judah Colt,	——, Pa.
1836	Timothy A. Conrad,	Philadelphia, Pa.
1823	Sherman Converse,*	New Haven, Conn.
1823	Fayette Cooper, M.D.,*	New York City.
1815	Isaac Cooper,*	Cooperstown.
1830	William Cooper,*	New York City.
1817	Alexander Coventry, M.D.,*	Utica.

1830	Ithamar B. Crawe, M.D.,*	Watertown.
1823	John B. Crouse, M.D.,	Bethlehem.
1830	Hooper Cumming, D.D.,*	Charlestown, S. C.
1851	James D. Dana, LL.D.,	New Haven, Conn.
1823	James F. Dana, M.D.,*	New York City.
1823	Samuel L. Dana,*	Boston, Mass.
1823	Charles Davies, LL.D.,	Fishkill Landing.
1837	Thomas L. Davies,	Woolwich, Eng.
1865	Henry B. Dawson,	Morrisania.
1813	James Dean, Jr.,*	Utica.
1830	James E. De Kay, M.D.,*	New York City.
1806	Pierre De La Bigarre,*	——, Dutchess county.
1830	John Delafield, Jr.,*	New York City.
1815	John Delamater, M.D.,*	Cleveland, O.
1830	Henry W. Delavan,*	Ballston.
1837	William H. DeVriese,	Amsterdam, Holland.
1853	Chester Dewey, D.D., LL.D.,*	Rochester.
1806	Benjamin DeWitt, M.D.,*	New York City.
1830	John DeWitt, D.D.,*	Brunswick, N. J.
1806	Frederick A. De Zeng,*	Clyde.
1823	John D. Dickenson,*	Troy.
1836	Judah Dobson,*	Philadelphia, Pa.
1823	Isaac Doolittle,*	Rochester.
1825	Jonathan Dorr, M.D.,*	Cambridge.
1823	David B. Douglass, LL.D.,*	Geneva.
1823	Daniel Drake, M.D.,*	Cincinnati, O.
1823	Judah T. Ducatel,*	Baltimore, Md.
1823	Amos Eaton,*	Troy.
1812	Caspar W. Eddy, M.D.,*	New York City.
1828	Bela Edgerton,*	Fort Wayne, Ind.
1830	Fay Edgerton,*	Utica.
1830	Andrew Edmeston,*	Edmeston.
1834	John Ehlers,	Hoboken, N. J.
1840	James Eights, M.D.,	Albany.
1818	Andrew Ellicott,*	West Point.
1860	Ezekiel B. Elliott,	Washington, D. C.
1808	Effingham Embree,*	——, Long Island.
1823	Ebenezer Emmons, M.D.,*	Brunswick, N. C.
1815	Adam Empie, D.D.,*	Wilmington, N. C.
1837	Peter Ewart,	Woolwich, Eng.
1811	Geo. W. Featherstonhaugh, F.R.S.,*	Duanesburgh.
1828	James Ferguson,*	Washington, D. C.
1851	Jose Fell Ferrao,	Maranham, Brazil.
1852	John Finch,	——, N J.
1837	William H. Fitton, M.D., F.R.S.,*	London, Eng.
1829	Peter Fleming,	——, Lower Canada.
1802	Ebenezer Foot,*	Delhi.
1828	Elial T. Foote, M.D.,	New Haven, Conn.
1810	Benjamin Ford,*	Albany.

1832	Elisha Fort, Jr.,	
1831	Joel Foster, M.D.,	New York.
1851	John W. Foster,	Chicago, Ill.
1864	John Fowler, Jr.,	New York City.
1813	John W. Francis, M.D., LL.D.,*	New York City.
1858	John H. French, LL.D.,	Albany.
1830	Henry I. Frey,*	Palatine.
1837	R—— H. Gardiner,	Gardiner, Me.
1808	David Gardiner,*	Gardiner's Island.
1808	John Lyon Gardiner,	Gardiner's Island.
1831	Jacob Gebhard,*	Schoharie Court House
1831	John Gebhard,*	Schoharie Court House.
1834	John Gebhard, Jr.,	Schoharie Court House
1806	James Geddes,*	Onondaga.
1809	Edmond C. Genet,*	Greenbush.
1814	George C. Gibbs,*	New York City.
1836	Charles Gill,*	Flushing, L. I.
1851	William M. Gillespie, LL.D.,*	Schenectady.
1833	Jonathan Goodhue,*	New York City.
1828	Nathaniel Goodwin,	Hartford, Conn.
1806	James G. Graham, M.D.,*	Shawangunk.
1830	Asa Gray, LL.D.,	Cambridge, Mass.
1837	George R. Gray,	London, Eng.
1837	John E. Gray, F.R.S.,	London, Eng.
1811	Jacob Green, M.D.,*	Philadelphia, Pa.
1828	Alpheus S. Greene, M.D.,*	Watertown.
1870	Dudley S. Gregory,	Jersey City, N. J.
1815	John Griscom, LL.D.,*	New York City.
1817	James Hadley, M.D.,*	Buffalo.
1834	Fletcher M. Haight,*	Santiago, Cal.
1811	Samuel Haight,*	Athens.
1833	William F. Haile,*	Plattsburgh.
1870	Hiland Hall,	North Bennington, Vt.
1840	James Hall, LL.D.,	Albany.
1831	Henry Hamilton,*	——, Schoharie county.
1823	William S. Hamilton,	——, Ill.
1823	Robert Hare, M.D., LL.D.,*	Philadelphia, Pa.
1836	Richard Harlan, M.D.,*	Philadelphia, Pa.
1823	Zina H. Harris, M.D.,	New York city.
1811	Samuel Hawkins,*	——, Ulster county.
1833	Sidney Hawes,	
1833	Francis L. Hawks, D.D.,*	New York.
1823	Horace Hayden, M.D.,*	Baltimore, Md.
1830	Isaac Hayes, M.D.,	Philadelphia, Pa.
1833	—— Hecker, (Prof.),	
1832	Elihu Hedges, M.D.,	New Windsor.
1815	Cornelius P. Heermance, M.D.,*	Ithaca.
1836	William Hembel,*	Philadelphia, Pa.
1830	William D. Henderson,*	New York City.

1809	Matthias B. Hildreth,*	——, Montgomery county.
1830	Paul Hochstrasser,*	Albany.
1832	William Hogan,*	——, Franklin county.
1811	John C. Hogeboom,*	Claverack.
1819	Myron Holley,*	Lyons.
1823	Charles Hooker, M.D.,*	New Haven, Conn.
1813	Adam Hoops,*	Albany.
1830	William R. Hopkins,*	Philadelphia, Pa.
1834	William Horton, M.D.,*	Blooming Grove.
1851	Franklin B. Hough,	Lowville.
1833	Sidney Howe,	Guilderland.
1811	Ruggles Hubbard,*	New York City.
1814	Jonas Humbert,*	New York City.
1834	Charles Humphrey,*	Ithaca.
1823	Seth Hunt,*	Alabama, (?).
1830	Rev. Joseph Hurlburt,*	New London, Conn.
1816	Jabish N. M. Hurd,*	Albany.
1806	Isaac Hutton,*	——, Columbia county.
1830	Isaac G. Hutton,*	——, Washington county.
1834	Rutger B. Huygens de Lowendahl,*	——, Holland.
1809	James Hyatt,	New York City.
1823	William Hyde,	Philadelphia, Pa.
1823	Henry Inman,*	New York City.
1836	Charles T. Jackson, M.D.,	Boston, Mass.
1830	Isaac W. Jackson, LL.D.,	Schenectady.
1833	Benedict Jarger,*	Princeton, N. J.
1823	Edwin James, M.D., U. S. A.*	Burlington, Iowa.
1816	William H. Jephson,*	New York City.
1865	Horatio Gates Jones,	Philadelphia, Pa.
1830	Benjamin F. Joslin, M.D., LL.D.,*	New York City.
1811	James Kent, LL.D.,*	New York City.
1830	Moss Kent,*	Plattsburgh.
1830	William Kent, LL.D.,*	New York City.
1827	Chevalier de Kirckhoff, M.D.,	Antwerp, Netherlands.
1812	Harman Knickerbacker,*	Schaghticoke.
1823	William Langstaff, M.D.,	New York City.
1830	Oliver Lathrop, M.D.,*	Albany.
1830	Isaac Lea, LL.D.,	Philadelphia, Pa.
1830	Francis Le Barron, M.D.,*	Washington, D. C.
1806	Morgan Lewis,*	Clinton, (Dutchess county).
1806	Ezra L'Hommedieu,*	Southold, L. I.
1811	John Lincklaen,*	Cazenovia.
1809	Edward P. Livingston,*	Clermont.
1810	Henry W. Livingston,*	Claverack.
1806	Robert R. Livingston, LL.D.,*	Clermont.
1815	William Livingston,*	Claverack.
1836	John Locke,*	Cincinnati, O.
1862	Charles E. Loosey,	New York City.
1841	Henry W. Longfellow, LL.D.,	Cambridge, Mass.

1811	John Low, M.D.,*	Charlton.
1810	James Lynch,*	New York City.
1815	Jared Mansfield,*	West Point.
1823	George Marvin, M.D.,*	Rochester.
1869	James Weir Mason,	Springfield, Mass.
1814	Thomas McAuley, D.D., LL.D.,*	New York City.
1836	John McLeod,	Montreal, L. C.
1836	Thomas McEwen, M.D.,	Philadelphia, Pa.
1808	Archibald McIntyre,*	New York City.
1815	Rev. John McJimsey,*	Poughkeepsie.
1811	Levi McKean,*	Newburgh.
1834	Peter McKilvey, M.D.,	Francisville, Ind.
1818	Robert McMillan, M.D.,*	U. S. Army.
1823	Andrew McNab,*	Geneva.
1830	William J. McNevin, M.D.,*	New York City.
1812	John Melish,*	Philadelphia, Pa.
1815	Thomas Melville,*	Boston, Mass.
1857	William Menzies,	New York City.
1828	William Merritt,	St. Johns, N. B.
1813	Morris S. Miller,*	Utica.
1808	Sylvanus Miller,*	New York City.
1813	Charles Mitchell,	——, Md.
1815	Samuel L. Mitchill, M.D., LL.D.,*	New York City.
1858	David E. E. Mix,	Batavia.
1868	Lewis H. Morgan,	Rochester.
1830	William H. Morrell, C.E.,*	Cooperstown.
1812	William W. Morris,*	Ballston.
1823	James O. Morse,*	Cherry Valley.
1833	Samuel G. Morton, M.D.,*	Philadelphia, Pa.
1823	Ellice Murdock, M.D.,	Clarkson.
1863	David Murray, Ph. D.,	New Brunswick, N. J.
1841	Rev. Ephraim H. Newton,*	Cambridge.
1813	John Nicholson,*	Newport.
1823	Joel B. Nott,	New York City.
1813	Josiah Noyes, M.D.,*	Clinton, (Oneida county).
1823	Thomas Nuttall,*	Cambridge, Mass.
1851	Edward B. O'Callaghan, LL.D.,	Albany.
1817	John Ogilvy,*	Montreal, L. C.
1811	Beriah Palmer,*	Ballston.
1834	Amasa J. Parker, LL.D.,	Albany.
1815	Alden Partridge,*	Norwich, Vt.
1823	James Pierce,	——, Greene county.
1823	Jacob Pierce,	Philadelphia, Pa.
1811	Jonas Platt,*	Plattsburgh.
1829	Jacob Porter, M.D.,*	Plainfield, Mass.
1814	William M. Price,*	New York City.
1837	James Prinsep,	Calcutta, Asia.
1837	Adolphe Quetelet,	Brussels, Belgium.
1813	John Randel, Jr.,*	Philadelphia, Pa.

1828 William E. Rapelye,* - - Fishkill.
1823 David Raymond, - - - Baltimore. Md.
1866 Peter Redpath, - - - Montreal, L. C.
1837 William C. Redfield,* - - New York City.
1870 Kenneth Reid, M.D., - - New York City.
1823 James Renwick, LL.D.,* - - New York City.
1817 Stephen Reynolds, M.D., - - ——, Montgomery county.
1830 Walter Reynolds,* - - - Pine Plains.
1809 Luther Rich,* - - - Cherry Valley.
1832 Obadiah Rich,* - - - - London, Eng.
1836 John D. Robertson, - - - London, Eng.
1823 J. Smythe Rodgers, M.D., - - New York City.
1811 John R. B. Rodgers, M.D., - - New York City.
1808 Nicholas Romayne, M.D.,* - - New York City.
1806 John B. Romeyn, D.D.,* - - New York City.
1812 Erastus Root,* - - - - Delhi.
1808 William Ross,* - - - Newburgh.
1830 John Russell,* - - - - Cooperstown.
1806 Samuel Russell,* - - - Buffalo.
1830 David Rust,* - - - - Alabama, (?).
1810 Benjamin Sanford,* - - - ——, Onondaga county.
1837 Adrian Schaff, Jr., - - - Amsterdam, Holland.
1823 Henry R. Schoolcraft,* - - Washington, D. C.
1812 Philip I. Schuyler,* - - - Rhinebeck.
1810 Rensselaer Schuyler,* - - Stillwater.
1811 John V. D. Scott,* - - - Catskill.
1809 Theodore Sedgwick,* - - Stockbridge, Mass.
1840 Edward O. Sewall, - - - Montreal, L. C.
1823 Stephen Sewall,* - - - Montreal, L. C.
1830 Thomas Sewall, M.D.,* - - - Washington, D. C.
1830 William Shaler,* - - - Havana, W. I.
1812 Alexander Sheldon,* - - - Charleston, N. C.
1830 Benjamin Silliman, LL.D.,* - New Haven, Conn.
1823 James Simonson (Lieut.) U. S. A.,* - ——, Cuba, W. I.
1816 Asa B. Sizer, M.D.,* - - Madison.
1842 Avery J. Skilton, M.D.,* - - Troy.
1836 Augustus W. Smith, LL.D.,* - Annapolis, Md.
1823 John W. A. Smith, (Lieut.) U. S. A.,* - ——, Me.
1833 Joseph W. Smith, M.D.,* - - Ogdensburgh.
1830 Isaac W. Smith, M.D.,* - - - Lockport.
1812 Nathan Smith,* - - - Fairfield.
1806 Peter Smith,* - - - - Peterboro'.
1830 Richard L. Smith,* - - - Auburn.
1828 Samuel Smith, - - - - ——, Greene county.
1830 William Souls,* - - - New York City.
1812 Horatio G. Spafford, LL.D.,* - - Waterford.
1825 Lyman A. Spalding, - - Lockport.
1823 Thomas Spencer, M.D.,* - - Geneva.
1870 Ainsworth R. Spofford, - - Washington, D. C.

1812	John Stearns, M.D.,*	New York City.
1823	Cyrus M. Stebbins,*	Hudson.
1834	Ebenezer Steele, M.D., *	Delhi.
1823	John H. Steele, M.D.,*	Saratoga Springs.
1807	John Stevens,*	Hoboken, N. J.
1823	Matthew Stevenson, M.D.,*	Newburgh.
1818	William L. Stone,*	New York City.
1865	William L. Stone, Jr.,	New York City.
1815	Farrand Stranahan,*	Cooperstown.
1870	Edwin A. Strong,	Grand Rapids, Mich.
1808	Selah Strong,*	New York City.
1818	Theodore Strong, LL.D.,*	New Brunswick, N. J.
1865	Russell Sturgis, Jr.,	New York City.
1865	Samuel T. C. Sweezey,	San Francisco, Cal.
1815	Joseph G. Swift,	New York City.
1827	Baron Alfonse de Syon,	——, France.
1830	George Talcott, (Gen.) U. S. A.,*	Albany.
1833	Richard C. Taylor,*	Philadelphia, Pa.
1823	David Thomas,*	Scipio.
1814	Andrew Thompson,*	Buffalo.
1815	George M. Tibbits,*	Troy.
1810	Isaac H. Tiffany,*	Esperance.
1865	Samuel D. Tillman, LL.D.,	New York.
1833	Ira Tillotson,	Ithaca.
1810	Robert R. Tillotson,*	Red Hook.
1823	William U. Titus,	New York City.
1823	Charles H. Tomlinson,*	Schenectady.
1808	Daniel D. Tompkins, *	Staten Island.
1870	Joseph M. Toner, M.D.,	Washington, D. C.
1837	Henry Tooley, Sr., M.D.,	Natchez, Miss.
1823	John Torrey, M.D.,	New York City.
1834	Silas Totten, D.D., LL.D.,	Lexington, Ky.
1834	Charlemagne Tower,	Pottsville, Pa.
1823	Peter S. Townsend, M.D.,*	New York City.
1823	William Tracy, LL.D.,	New York City.
1818	Amasa Trowbridge, M.D.,*	Watertown.
1807	John Tryon,*	——, Columbia county.
1808	Henry Tucker,*	Newburgh.
1830	William Tully, M.D.,*	Springfield, Mass.
1830	Comfort Tyler,*	Montezuma.
1808	Philip Van Cortlandt,*	Cortlandt.
1815	Pierre Van Cortlandt,*	Cortlandt.
1812	John C. Vanderveer,	——, Kings county.
1837	G—— A. Vandervoort,	Amsterdam, Holland.
1833	Jacob A. Van Huevel,	Vernon Centre.
1807	William W. Van Ness,*	Hudson.
1834	Alexander Van Rensselaer,	New York.
1823	Jeremiah Van Rensselaer, M.D.,	Greenbush.
1866	Maunsell Van Rensselaer, D.D.,	Geneva.

1823	Lardner Vanuxem,*	Bristol, Pa.
1830	Henry D. Varick,	Poughkeepsie.
1870	Marvin R. Vincent, D. D.,	Troy.
1809	Herman Vosburgh,*	Kinderhook.
1808	William W. Vredenburgh,*	Skaneateles.
1830	Alexander Walsh,*	Lansingburgh.
1829	David B. Warden,*	Paris, Fr.
1823	Charles M. Watson,*	Port Kent.
1830	Winslow C. Watson,	Port Kent.
1830	Ashbel S. Webster, M.D.,*	Albany.
1823	Horace Webster, LL.D.,	Geneva.
1830	Noah Webster, LL.D.,*	New Haven, Conn.
1828	Cornelius D. Westbrook, D.D.,*	Kingston.
1865	Everett P. Wheeler,	New York City.
1823	Canvas White,*	Whitesboro'.
1823	Delos White, M.D.,*	Cherry Valley.
1815	Charles Whitlow,*	London, Eng.
1851	Josiah D. Whitney,	Cambridge, Mass.
1823	John C. Whitney,	Great Barrington, Mass.
1808	James W. Wilkin,*	Goshen.
1816	Jephthah A. Wilkinson,*	Cherry Valley.
1830	Erastus Williams, M.D.,*	Knox.
1817	Nathan Williams,*	Utica.
1823	Thomas S. Williams,*	Utica.
1830	Thomas M. Willing,*	Philadelphia.
1851	Westel Willoughby, M.D.,*	New York City.
1859	Jacob Wilson,	Newark.
1867	John M. Wilson, (Col). U. S. A.,	Albany.
1810	Polydorus B. Wisner,*	Geneva.
1828	William C. Woodbridge,*	Boston, Mass.
1817	Benjamin Wright,*	Rome.
1831	John C. Wright,*	Schenectady.
1860	James Wynne,	New York City.
1823	Christopher C. Yates, M.D.,*	Parishborough, N. S.
1807	Joseph C. Yates,*	Schenectady.
1808	Peter W. Yates,*	——, Onondaga county.
1810	John Young,*	Whitestown.

Number of Corresponding Members, - 420.

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1867 Rev. Reinhold Adelberg.
1867 Joseph Alden, D.D., LL.D.
1823 Joseph Alexander.*
1864 Leicester Allen.
1869 Rev. John M. Allis.
1830 William Alvord.*
1823 Julius R. Ames.*
1836 William Annesley.*
1841 Charles H. Anthony.
1865 Oliver Arey.
1840 James H. Armsby, M.D.
1841 Charles L. Austin.*
1859 Horace Averill.
1866 Daniel L. Babcock.
1864 James L. Babcock, M.D.
1831 Marshall J. Bacon.
1870 James S. Bailey, M.D.
1867 John M. Bailey.
1870 William H. Bailey, M.D.
1830 Henry W. Bamman.*
1865 Robert L. Banks.
1833 Daniel D. Barnard.*
1852 Frederick J. Barnard.
1851 Samuel W. Barnard.
1852 William Barnes.
1852 Rufus G. Beardslee.
1830 Lewis C. Beck, M.D.*
1829 Nicholas F. Beck, LL.D.*
1812 T. Romeyn Beck, M.D., LL.D.*
1869 Thomas Beckett, M.D.
1852 Luther F. Beecher, D.D.
1870 Henry M. Benedict.
1852 Ephraim H. Bender.
1841 Lewis Benedict, Jr.*
1866 George H. Benjamin.
1870 John M. Bigelow, M.D.
1859 Reuben H. Bingham.
1829 S. De Witt Bloodgood.*
1869 Rev. William S. Boardman
1830 William H. Bogart.
1866 Arthur Bott.
1866 Jephthah R. Boulware, M.D.
1851 David I. Boyd.
1833 William S. Boyd.
1810 Rev. John M. Bradford, D.D.*
1869 John E. Bradley.
1870 Chas. D. W. Bridgman, D.D.
1859 Marshall K. H. Bright.
1840 Edward Brinckerhoff.*
1832 Henry Bronson, M.D.
1860 Andrew E. Brown.
1852 A. Hyer Brown,*
1870 James C. Brown.
1829 Rev. David Brown.
1823 Jesse Buel.*
1864 Henry T. Buell.
1829 Peter Bullions, D.D.*
1825 Asa Burbank, M.D.
1832 Henry Burden, (Troy).
1863 Edward E. Burnet.
1852 Walter R. Bush.
1830 Benjamin F. Butler, LL.D.*
1830 William Caldwell.*
1813 Archibald Campbell.*
1858 Duncan Campbell.
1839 John N. Campbell, D.D.*
1851 William H. Campbell, D.D.
1869 Edward A. Carpenter, M.D.
1829 George W. Carpenter.
1841 Ezra R. Carr.
1858 Howard Carroll.*
1831 John P. Cassidy.*
1857 William Cassidy.
1865 Michael P. Cavert.
1870 Frank Chamberlain.
1866 Alfred F. Chatfield.
1830 Asa Chester, M.D.
1815 John Chester, D.D.*
1836 Charles Clapp.
1824 Walter Clark.*
1851 William W. Clark.
1827 Aaron Clarke.*

1831 George Clarke.
1826 George W. Clinton, LL.D.
1831 William D. Cochran.
1836 Mason F. Cogswell, M.D.*
1835 Andrew J. Colvin.
1868 Verplanck Colvin.
1823 Alfred Conkling.
1833 Lawrence Connor.
1851 George H. Cook, LL.D.
1867 Leroy C. Cooley.
1865 John A. Cooper.
1857 John Tayler Cooper.
1858 Paul F. Cooper.
1830 William Cooper.*
1870 Clarence H. Corning.
1828 Erastus Corning.
1826 Alonzo Crittenden, Ph.D.
1823 Edwin Croswell.
1857 James Cruikshank, LL.D.
1840 Thomas H. Cushman.
1831 William M. Cushman.
1869 Edward Danforth.
1867 Henry Darling, D.D.
1857 Gilbert C. Davidson.*
1867 James Davis.
1832 John Davis.*
1832 Amos Dean, LL.D.*
1829 Jesse De Graff.
1828 Edward C. Delavan.
1869 Philander Deming.
1835 Hugh Denniston.*
1870 Abraham V. DeWitt.
1831 Lewis De Witt.*
1827 Richard Varick De Witt.*
1857 Richard Varick De Witt, Jr.
1806 Simeon De Witt.*
1827 George Dexter.
1834 James Dexter.*
1830 John Ogden Dey.*
1870 Andrew Dickey.
1867 George L. Ditson, M.D.
1833 John A. Dix, LL.D.
1869 Rt. Rev. William C. Doane, D.D.
1842 Edwin A. Doolittle.
1833 O ——— M. Dorman.
1863 Lockwood L. Doty.
1832 Volkert P. Douw.*
1870 Volckert P. Douw.
1828 Charles E. Dudley.*
1823 Edward Dunn.* [A., West Troy.
1870 Clarence E. Dutton, (Capt). U. S.
1866 Alfred Edwards.
1866 Isaac Edwards.
1823 James Edwards.*
1823 James Eights, M.D.
1812 Jonathan Eights, M.D.*
1866 Joachim Elmendorf, D.D.
1865 George V. Emerson.*
1869 James H. Emerton.
1842 Ebenezer Emmons, M.D.*
1835 James Ferguson.*
1830 Isaac Ferris, D.D., LL.D.
1830 Lancelot Fidler.*
1829 Peter Fleming.
1868 Townsend Fondey.
1832 William H. Fondey.*
1833 Edward W. Ford.*
1833 John M. Ford.
1834 William W. Forsyth.*
1851 Samuel H. Freeman, M.D.
1851 Abel French.
1833 James M. French.*
1832 William W. Frothingham.
1866 Robert M. Fuller.
1806 Peter Gansevoort.*
1815 Peter Gansevoort.
1869 Charles H. Gaus.
1834 Rev. John M. Garfield.
1841 John E. Gavit.
1857 Joseph Gavit.
1857 John P. S. Gifford.
1825 James S. Goold.*
1852 John Gott.
1858 Benjamin A Gould, Jr., M.D.
1836 Charles D. Gould.*
1868 William J. Graff.
1815 Matthew Gregory.*
1828 Henry Greene, M.D.*
1870 Stephen B. Griswold.
1852 Stephen Groesbeeck.
1809 Henry Guest.*
1857 William Hagen, M.D.
1851 James Hall, LL.D.
1841 John H. Hall.*
1867 John Tayler Hall.
1870 Lewis Benedict Hall.
1867 Samuel Hand.
1870 Thomas L. Harison.

1833 Thomas W. Harman.*
1851 Ira Harris, LL.D.
1833 Henry Hart.*
1833 Seth Hastings.*
1851 Henry B. Haswell.*
1823 Gideon Hawley, LL.D.
1851 Henry Q. Hawley.
1868 Adelbert D. Head, M.D., (Troy).
1858 James Hendrick.
1823 Joseph Henry, LL.D.
1857 John H. Hickcox.
1833 Robert J. Hilton.
1868 John V. R. Hoff.
1865 Peter Hogan.
1868 Almon Holland.
1869 Alexander L. Holley, (Troy).
1857 Henry A. Homes.
1814 Philip Hooker.*
1869 Charles E. Horne.
1841 Eben N. Horsford.
1855 Franklin B. Hough, M.D.
1860 George W. Hough.
1866 John C. House, (Waterford).
1819 Estes Howe.*
1870 Charles S. Hoyt, M.D.
1833 Lorenzo Hoyt.*
1835 Levi Hubbell.
1832 Correll Humphrey, M.D.*
1867 Edward R. Hun, M.D.
1828 Thomas Hun, M.D.
1851 John McD. McIntyre.
1859 George P. Jackson.
1832 William Jackson.
1858 William A. Jackson.*
1842 Edward James.*
1831 Henry James.
1831 John James, M.D.*
1831 John B. Jarvis.
1867 Charles M. Jenkins.
1808 Elisha Jenkins.*
1857 Ezekiel Jewett.
1857 Alexander S. Johnson, LL.D.
1851 James I. Johnson.
1857 Benjamin P. Johnson.*
1838 Hugh B. Jolly.
1869 Morven M. Jones
1828 Oliver Kane.*
1833 Robert L. Kearney.*
1831 Rev. William L. Keese.*
1858 Edward E. Kendrick.
1870 Addison A. Keyes.
1869 Emerson W Keyes.
1866 James Kidd.
1866 Rodney G. Kimball.
1866 Dwight King.
1831 Joshua I. King.
1865 Leonard Kip.
1852 Rt. Rev. William I. Kip, D.D.
1866 William Lacy.
1833 John B. La Forge.*
1866 Abraham Lansing.
1842 Charles B. Lansing.
1864 John V. Lansing, M.D.
1829 Augustus F. Lawyer, M.D.
1866 William L. Learned.
1866 George W. Lewis.
1815 Stewart Lewis.*
1869 Joseph A. Lintner.
1851 Edwin C. Little.
1828 Weare C. Little.
1833 Cicero Loveridge.*
1808 James Low, M.D.*
1858 David B. Luther.
1866 Robert Macfarlane.
1852 Henry Mandeville, D.D.
1851 Henry March, M.D.
1828 William L. Marcy, LL.D.*
1852 Benjamin N. Martin, D.D., L.H.D.
1835 Henry H. Martin.
1867 Henry T. Martin.
1826 William Martin.
1869 Selden E. Marvin.
1863 James Weir Mason.
1830 Frederick Matthews.*
1815 William Mayell.*
1851 William J. McAlpine.
1857 Henry S. McCall.
1852 William McCammon.
1808 William McClelland M.D.*
1841 Archibald McClure.
1857 Amasa McCoy.
1829 William A. McCulloch.
1836 Alexander B. McDonal.*
1852 William McElroy.
1867 William C. McHarg.
1836 Archibald McIntyre.*
1835 Rev. Robert McKee.*
1823 Duncan McKercher.*

1833 David McLaughlan, M.D.
1869 John W. McNamara.
1823 James McNaughton, M.D.
1860 Melvin N. Mead, M.D.
1823 Orlando Meads.
1828 Henry D. Meech.
1830 Richard M. Meigs.
1870 Otto Meske.
1806 Rev. Alexander Miller.
1852 Rev. William A. Miller.*
1823 William C. Miller.*
1870 Theodore F. Miner.
1859 W——— C. Minor.
1840 Julien Molinard.*
1865 Levi Moore, M.D.
1866 William D. Morange.
1869 Cornelius D. Mosher, M.D.
1863 Jacob S. Mosher, M.D.
1827 Isaac Mott.*
1824 Joseph P. Mott.*
1841 Joel Munsell.
1867 Frederick W. Munson.
1857 David Murray, Ph. D.
1842 David Newcomb, M.D.
1830 George Newell.
1835 George W. Newell.*
1852 John Newland.
1833 Luke F. Newland.*
1852 Richard H. Northrop.*
1830 John T. Norton.*
1870 John T. Norton. [LL.D.
1852 Edward B. O'Callaghan, M.D..
1834 Howard Nott.*
1830 William O'Donnell, M.D.*
1852 Thomas W. Olcott.
1870 Abraham F. Onderdonk.
1859 Lysander A. Orcutt.
1851 Abijah Osborn.
1830 John K. Paige.*
1863 Henry D. Paine, M.D.
1869 Horace M. Paine, M.D.
1857 Erastus D. Palmer.
1851 Amasa J. Parker, LL.D.
1866 Amasa J. Parker, Jr.
1829 Philip S. Parker.*
1831 William Parmelee.*
1842 L. Sprague Parsons.*
1869 Wesley W. Pasko.
1833 John Paterson.
1814 George Pearson.*
1841 Erastus H. Pease.
1841 Frederick S. Pease.*
1869 Charles H. Peck.
1851 George R. Perkins, LL.D.
1842 John S. Perry.
1851 William F. Phelps.
1834 Henri Picard.*
1816 Charles Z. Platt.*
1852 Josiah B. Plumb.
1865 James E. Pomfret, M.D.*
1840 Horatio Potter, D.D.
1829 Titus W. Powers, M.D.
1865 Daniel J. Pratt.
1870 Richard Prescott.
1867 Erastus C. Pruyn.
1831 John V. L. Pruyn, LL.D.
1833 Lansing Pruyn.
1870 Robert C. Pruyn.
1839 Robert H. Pruyn.
1842 Samuel Pruyn.*
1851 John V. P. Quackenbush, M.D.
1851 Samuel S. Randall.
1851 Albion Ransom.
1869 Clarence Rathbone.
1858 Joel Rathbone.*
1851 John F. Rathbone.
1867 John Meredith Read, Jr.
1858 Charles B. Redfield.
1852 James Redfield.*
1869 Rev. J. Livingston Reese.
1810 John Reid.* [West Troy.
1870 James W. Reilly, (Capt.) U. S. A.
1852 Dexter Reynolds.
1841 Marcus T. Reynolds.*
1828 Walter G. Reynolds.
1869 William A. Rice.
1836 Julius Rhoades.*
1868 Charles A. Robertson, M.D.
1816 Hugh Robison.*
1829 William S. Rockwell.*
1834 Arthur H. Root.*
1865 Simon W. Rosendale.
1859 George S. Rugg.
1870 Charles E. Russ.
1864 Joseph W. Russell.
1851 James H. Salisbury, M.D.
1865 James B. Sanders.
1859 Joseph P. Sanford.

1851 Edward Satterlee.
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1869 Charles H. Gaus.
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MEETINGS AND REPORTS OF CLASSES FOR 1870.

REGULAR SEMI-MONTHLY MEETINGS, at the rooms of the Institute in the Albany Academy, on the *first and third Tuesday evenings of each month* from January to June inclusive, and from October to December, inclusive.

ANNUAL MEETING, in connection with the first regular meeting of the year.

FOUR SPECIAL FIELD MEETINGS during the summer months of 1870:
At Schoharie Court House, May 28.
At Luzerne, June 18.
[Other appointments to be made hereafter.]

FIRST REGULAR MEETING after Summer recess, October 4, 1870.

SECOND REGULAR MEETING after summer recess, October 18, 1870.

REPORTS OF CLASSES in the several departments, will be due, at subsequent regular meetings, under the 21st by-law of the Institute, as follows:

November 1, 1870.
First Department — First Class,....Physics and Astronomy.

November 15, 1870.
Second Department — First Class,..Geology.

December 6, 1870.
Third Department — First Class,...Modern History.

December 20, 1870.
First Department — Second Class,..Physiology and Chemistry.

January 3, 1871.
ANNUAL MEETING.

January 17, 1871.
Second Department — Second Class, Botany.

February 7, 1871.
Third Department — Second Class, .Ancient History and Archæology.

February 21, 1871.
First Department — Third Class,...Arts.

March 7, 1871.
Second Department — Third Class,..Zoölogy.

March 21, 1871.
Third Department — Third Class,..General Literature.

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ERRATA.

Page 80, third line from bottom, for "Keen," read *Keene*.
last line, for "Arnigerum," read *Urnigerum*.
Page 112, line 24th, for "Argonants," read *Argonauts*.
Page 120, line 22d, for "Esop," read *Æsop*.
Page 173, sixth line from bottom, for "formulæ," read *formula*.
Page 174, lines 11 and 18, ditto.
Page 176, line 5, ditto.
Page 228, ninth line from bottom, for "racoon," read *raccoon*.
Page 249, last line but one, for "Vangondy," read *Vaugondy*.
Page 288, lines 2d and 23d, for "Henry T. Buel," read Henry T. *Buell*.
line 17th, for "*Naturalist's Dictionary*," read *Naturalist's Directory*.
fifth line from bottom, for "Mr. Reid," read Mr. *Read*.
Page 290, fourth line from bottom, same correction as last above.
Page 293, line 3d, for "Labradorish," read *Labradorite*.
Page 302, line 18th, for "James C. Graham," read James *G*. Graham.
Page 324, line 12th, George Bomford is not in proper alphabetical position; should be on preceding page.
Page 338, second column, 4th line from bottom, for "1769," read 1869.
Page 341, line 10th, second column, for "Charles D. Mosher," read *Cornelius* D. Mosher.

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